ISSN 0972-2378

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CMFRI

वार्षिक प्रतिवेदन
Annual Report
2006-07

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Annual Report

2006-2007

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ICAR

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Post Box No. 1603, Ernakulam North P.O., Cochin - 682 018, India

CMFRI Annual Report 2006-2007

Published by
Prof. (Dr.) Mohan Joseph Modayil
Director

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Dr. P. Jayasankar
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Hindi Translation
Mrs. P.J. Sheela

Word Process and Secretarial Assistance
Ms. G. Manjusha Menon
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Printed at
Niseema Printers & Publishers
SRM Road, Cochin - 18
Ph : 2403760, 2402948

Hatchery produced juveniles of the ornamental fish *Premnas biaculeatus*. The institute developed hatchery technology for 10 species of marine ornamental fishes

Cover design & Layout : - Dr. E.V. Radhakrishnan

ISSN 0972-2378

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Citation: CMFRI. 2006. *Annual Report 2006-2007*. Central Marine Fisheries Research Institute, Cochin, 126 p.

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PREFACE

Since marine fishery resources are dynamic and renewable to a certain extent, regular assessment and monitoring should be carried out to ensure their sustainability. The major mandates of CMFRI include monitoring and assessment of exploited marine fishery resources, giving more thrust on conservation of marine biodiversity, development of appropriate mariculture technologies for increasing fish and shellfish production and assurance of livelihood security of the fishers through socioeconomic interventions. During the past year 2006-07, CMFRI was able to implement 14 divisional, 13 interdivisional, 1 inter-institutional and 18 sponsored and 4 consultancy projects with a view to fulfilling these objectives.

The marine fish landings of India during 2006-07 have recorded an increase of about 4.1 lakh tonnes over the previous year due mainly to substantial increase in the catches of small pelagics. All maritime states and Union territories except Orissa and Lakhadweep registered higher catches compared to last year. However, in several states, most of the important marine fishery resources are overexploited, calling for urgent steps, such as fleet size reduction for conservation and management.

All India marine fisheries census carried out by the Institute with the financial support of DAHD&F, MOA revealed that there are 3,202 marine fishing villages in the country with a total population of 3.52 million living in 7.6 lakh households. Low-value by-catch and discards generated by bottom trawling varied from 1000 to 40,000 t at various landing centres.

Climate change (especially SST), which has taken place during the past 40 years appears to have resulted in the shifting of distribution and spawning season of some of the important fishfish species. GIS-based investigations have identified 45 potential mariculture sites including suitable locations for open sea cage culture along both the coasts of India.

CMFRI has taken significant steps in creating awareness among the fishers on the adverse impact of destruction of juvenile shrimps and establishment of artificial reefs in the nursery areas and promotion of gears like hooks and line for exploitation of the resources.

Additional information on the biodiversity of fish and shellfish from 500-1000m depth zone off east coast, southeast coast and Andaman waters was gathered through deep-sea fishing surveys.

During 2006-07, the Institute has made 106 sightings of marine mammals from Arabian sea, Bay of Bengal and Andaman waters. A total of 24 mtDNA sequences from 19 individuals of 8 marine mammal species were deposited in the GenBank (www.ncbi.nl.nih.gov/). Molecular taxonomy and PCR-based gender identification method were successfully applied for the species identification and sexing of stranded whales and accidentally caught dolphins, porpoise and dugong.

In the Gulf of Mannar Biosphere Reserve (GOMBR), the reefs around Manauli were the richest in biodiversity with a Shannon index of 2.97. Ten species each of gorgonids and soft corals were identified and documented from the GOMBR.

Progress has been made in the rearing of phyllosoma larvae of *Panulirus homarus*. Trimming the antennae reduced aggressive behaviour in spiny lobsters considerably, thereby reducing cannibalism.

Total farmed mussel production during 2006 was 10,060 t from Kerala. The average productivity for the rack method was greater than that for the on-bottom method. *In-vitro* pearls were produced from molluscs other than the pearl oyster, like *Pteria* sp. and *Pinna* sp. Remote set spats of *Paphia malabarica* and *Pinctada fucata* showed higher growth rate in Ashtamudi lake. The mabe pearl culture technology has been refined by developing new designs.

Spawning and successful larval rearing of rabbitfish and seed production in 3 species of damsel fishes was achieved for the first time in India. Success in the captive spawning of spine-cheek anemone fish *Premnas biaculeatus* was noteworthy. Co-culturing of copepods in green water in the larviculture tank was shown to be the most effective larval rearing protocol for marine fishes. Open sea floating cages installed at Visakhapatnam and Diu, were stocked with seeds of sea bass *Lates calcarifer*.

Fermented tuna waste exhibited more nutritional value when fed to clownfish species. Enzymes phytase, acid phosphatase and triacylglycerol lipase were purified from microorganisms. Strains of *Vibrio* which are pathogenic to Groupers were isolated. Testing field samples of shrimp, *P. monodon* for WSSV produced contrasting results with histopathology and PCR, which highlights the need for validation of PCR results, especially in preserved samples. Phenotypic analysis showed the evidence of stock differences in Bombay duck between Northwest and Northeast coasts. Species-diagnostic RAPD bands were generated in 5 species of rock lobsters and 2 species of scyllarid losbsters.

Marine fishery resources, such as sharks, rockcods, snappers, pomfrets, and crabs maintained steady whole sale and retail prices throughout the year due to high consumer preference. There was a marked increase in value of marine fish landings this year compared to the previous year.

The response of the fisher community of Andhra Pradesh, Tamil Nadu, Orissa, West Bengal, Karnataka, Gujarat, Maharashtra and Kerala to monsoon fishing ban was analyzed by the Institute and found that except 50% of the mechanized sector of Kerala, the whole community approved it. Mussel farming faced negative externalities, such as clash of interest from the stake net fishers as well as spiraling cost of seed material.

In income generation, the Institute was able to achieve revenue of Rs. 115.18 lakhs and through ATIC a total income of Rs. 1,10,247/- during the reporting year. Consultancy services provided to different agencies generated Rs. 16.89 lakhs during 2006-07.

The major publications of the Institute staff included 1 bulletin, 5 special publications, 49 peer-reviewed papers, 17 popular articles, 67 technical articles and 11 papers in symposia/seminars. The Institute won the Best ICAR Annual Report Award and *Ganesh Sankar Vidyarthi Award* of ICAR for the year 2004 -2005.

Under human resources development, KVK conducted a total of 75 courses in addition to some front line demonstration and on farm testing programmes. Four regular students and project SRFs were awarded Ph.D degree and the same umber of students have been awarded degree by CIFE (Deemed University).

The summary and results of the research work carried out by the Institute during 2006-07 are furnished in this report. I am grateful to all my colleagues for these achievements. I am greatly indebted to Dr. Mangala Rai, Director General of ICAR for his guidance and support extended to achieve our goals. I wish to place on record my sincere gratitude to Dr. S. Ayyappan, Deputy Director General (Fy.) and Dr. A.D. Diwan, Assistant Director General (M.Fy.) for their incessant guidance and support. I am hopeful that this great Institute would achieve greater heights in the coming years.

10 June, 2007
Cochin

MOHAN JOSEPH MODAYIL
Director

EXECUTIVE SUMMARY

During 2006-07 CMFRI implemented 14 divisional, 13 interdivisional, 1 inter-institutional and 18 sponsored and 4 consultancy projects with focus on addressing issues related to sustainable exploitation of fishery resources from the wild, production through mariculture technologies and conservation of marine biodiversity. The major findings are presented below.

Capture fisheries

The marine fish landings of India during 2006-07 have been provisionally estimated at 2.71 million t, which recorded an increase of about 4.1 lakh tonnes over the previous year. The pelagic fishes constituted 55%, demersal fishes 24%, crustaceans 16% and molluscs 5% of the total landings. Among the commercially important groups, landings of oil sardine, ribbon fish, lesser sardines, cephalopods, Indian mackerel, croakers, perches, seer fish and non-penaeid shrimps registered increase, while those of Bombay duck, carangids and penaeid shrimps decreased compared to the previous year. Simulation of fishery from 2005 to 2015 was made for Kerala and Tamil Nadu using models developed suiting stock assessment of tropical multi-species and multi-gear systems.

About 43% increase in marine fish landings was registered in Gujarat during 2006-07, with ribbonfishes, non-penaeid shrimps, threadfin breams showing significant improvement in catches. Ribbonfish, Bombay duck, tuna, seerfish, lizardfish, croakers and Bull's eye were exploited above optimum level and threadfin breams at optimum level in Gujarat. In Maharashtra, the estimated marine fish landings registered an increase of 20% over the previous year, contributed by improved catch rates in dol nets and gill nets as well as due to increase in catches of ribbonfishes, eels, lobsters, mackerel, elasmobranchs and non-penaeid shrimps. The majority of the resources in Maharashtra were over-exploited, calling for urgent steps for conservation and management. Fleet size reduction by about 48% has suggested as one of the measures. In Karnataka and Goa also marine fish landings increased. In Karnataka, the ALTY was 2.1 lakh t against estimated landings of 2.41 lakh t during the current year. Oil sardine, ribbonfish, and threadfin breams were the major resources landed. In Goa, the ALTY was 96,065 t against the total catch of about 1.05 lakh t. Marine fish catch in Karnataka and Goa was valued at Rs. 66,045 lakhs and 24,821 lakhs, respectively. Based on experimental studies, appropriate mesh sizes were recommended for several commercially important species weighing <200 mg. In Karnataka and Goa, purseseine operators have the maximum monthly income and they ranked high fuel cost above resource depletion as their major occupational constraint. Marine fish landings in Kerala registered 10% increase during the current year compared to last year contributed mainly by small pelagics. The Average Long Term Yield (ALTY) of marine fish landings of Kerala was estimated at 6.25 lakh t against the estimated landings of 5.92 lakh t during 2006-07. Total marine fish landings dipped in Lakshadweep during 2006-07. Good potential for yellowfin tuna, belones and flying fishes was evident. Fishers earned substantially through sale of '*mas*'. It was indicated that fishing effort by the existing pole and line units have attained near optimum and maximum increase in fishing effort is limited to 20% of the existing effort to attain maximum economic yield.

Marine fish catch increased by 20% and 15% at Tamil Nadu and Pondicherry, respectively, recovering from the tsunami impact. Seerfish and tunas were heavily exploited at Tuticorin. Penaeid shrimps, blue crab and sand lobster were also exploited close to their MSY. In Andhra Pradesh, marine landings registered increase by 36%. Several species including *Rastrelliger kanagurta*, *Sardinella gibbosa*, *Trichiurus lepturus*, threadfin breams, croakers and penaeid shrimps were exploited at levels higher than the optimum whereas *S. guttatus* was exploited below the optimum level. About 12% decline in total marine landings was observed at Orissa compared to the previous year. Annual marine landings of West Bengal ranged from about 1.6 to 2.0 lakh t during 2002-06, with a declining trend in trawl landings, but perceptible increase in gill net catches. Bombay duck and shads were the dominant resources.

All India marine fisheries census was carried out by the Institute with the financial support of DAHD&F, MOA. There are 3,202 marine fishing villages in the country with a total population of 3.52 million living in 7.6 lakh households. Information on sex ratio of fisherfolk, their occupational details, possession of craft and gear, etc. were brought out through 13 separate reports printed and released.

Estimated quantity of low-value bycatch and discards generated by bottom trawling varied from about 1000 to 40,000 t at various landing centres, with very high figures at Veraval and Visakhapatnam. Value of bycatch at Veraval was almost Rs. 8 crores, while that at Visakhapatnam Rs. 12.6 lakhs. Twenty two ecological groups (fishery and non-fishery) were considered for building trophic models and fisheries management simulations from the Northwest coast and Gulf of Mannar ecosystems. Estimations on growth and mortality parameters, biomass, food and feeding were carried out.

Environmental and Biodiversity studies

Significant positive correlations were observed between the field measured Sea Surface Temperature (SST) and the satellite derived SST from inshore waters. Coastal upwelling along the southwest coast was evident during July to September with peak in August in the field and satellite derived oceanographic data. Catches of pelagic species, such as carangids, mackerel, seerfish and tuna showed significant positive correlation with bottom *sigma t* and significant negative correlation with bottom dissolved oxygen content.

Climate change (especially SST), which has taken place during the past 40 years appears to have resulted in the shifting of distribution of oil sardine to the northern latitudes in the Arabian sea and Bay of Bengal. Further, the spawning season of two dominant species of threadfin breams *Nemipterus mesoprion* and *N. japonicus* is shifting towards cooler months. Demography, food security and habitat induced maximum vulnerability of coastal fishers to climate change.

Toxic metal concentrations in the sediment samples as well as in fish and shellfish were generally within the permissible limits, though shellfish had relatively more concentration of metals, such as lead and cadmium in tissues. GIS-based investigations have identified 45 potential mariculture sites suitable including open sea cage culture along both the coasts of India.

During the current year, the reported mortality of olive ridley due to entrapment in fishing gear along the Northern Orissa coast was about 3000 compared to 4000 during the previous year. Hatchery produced young ones of *Holothuria scabra* numbering about 1200 were searanched.

Creation of awareness among the fishers on the adverse impact of destruction of juvenile shrimps and establishment of artificial reefs in the nursery areas and promotion of gears like hooks and line for exploitation of the resources are some of the management advisories suggested. Rampant exploitation of juveniles of Bombay duck, some clupeids, non-penaeid and penaeid shrimps in gears, such as dol nets and 'thalluvalai' can bring about substantial reduction in fish catches in the ensuing years. FADs and data buoys support good demersal fishery. Minimum size at first maturity was considered to differentiate juveniles from adult. Searanching programmes of *Penaeus semisulcatus* and *Pinctada fucata* were undertaken with a view to replenishing the wild stocks. Through concerted efforts on participatory management and conservation of lobster resources along the Indian coast, the Institute could generate awareness among the stake holders the need for adopting conservation measures.

A total of 111 species of finfishes, 9 species of shrimps, 3 species of crabs, 4 species of squids and 1 glass sponge were recorded during deep-sea fishing surveys in the 500-1000m depth zone off east coast, southeast coast and Andaman waters. The distribution of deep sea shrimps has indicated similarity in both the coasts and some of the large growing shrimps like *Acanthephyra armata* has shown good potential for exploitation. Occurrence of the glass sponge *Monorhaphis chuni* in the mud flats off Mangalore was an interesting observation.

During 2006-07, the Institute has made 106 sightings of marine mammals from Arabian sea, Bay of Bengal and Andaman waters. Stomach content analysis of 7 species of cetaceans indicated their food preference for finfishes. In cetaceans mercury accumulation was found to be higher in liver tissue than in kidney and muscle. Pesticide accumulation in the critically endangered *Dugong dugon* was analyzed. During the current year, a total of 24 mtDNA sequences from 19 individuals of 8 marine mammal species were deposited in the GenBank (www.ncbi.nl.nih.gov/) and the total repository of DNA sequences of whales, dolphins, porpoises and dugong contributed by the Institute stands at 63 from 44 individuals of 11 species. Molecular taxonomy and PCR-based gender identification method were successfully applied for the species identification and sexing of stranded whales and accidentally caught dolphins, porpoise and dugong. Some interesting observations on the *Sousa-Stenella-Tursiops-Delphinus* species complex and close genetic relationship of sperm whale (Odontoceti) with baleen whales (Mysteceti) were made.

Among the coral species, *Montipora digitata* was the most dominant species in the Gulf of Mannar Biosphere Reserve (GOMBR). The reefs around Manauli were the richest in biodiversity with a Shannon index of 2.97. Ten species each of gorgonids and soft corals were identified and documented from the GOMBR. Forty-five species of carangids under 15 genera were identified, photographed and morphometric and meristic characters documented.

Mariculture

The phyllosoma larvae of *Panulirus homarus* attained stage VIII in 42 days on an exclusive diet of PUFA-enriched *Artemia*. Sea ranched about 7.1 million post larvae of *Penaeus semisulcatus*. Black coloured tanks, restricted light exposure and rearing system with external biofilter and 70-100 cm high water column gave better colouration to the spiny lobsters. Trimming the antennae reduced aggressive behaviour considerably, thereby reducing cannibalism. In the raceway culture of *Penaeus semisulcatus*, average production was 0.35 kg/m^2.

Total farmed mussel production during 2006 was 10,060 t from Kerala. The average productivity for the rack method was estimated at 565 t/ha and that for on-bottom method 172 t/ha. In Kozhikode and Malapuram districts, 88 and 66% of the farmers, respectively were motivated by the training programme of the Institute. *In-vitro* pearls were produced from molluscs other than the pearl oyster, like *Pteria* sp. and *Pinna* sp. Work on the on-shore pearl production from *P. maxima* and *P. margaritifera* was continued. The highest settlement of oyster spat occurred on 25 mm lime coated clam shells. Clam *Paphia malabarica* seeds grew from 9.3 mm to 32.1 mm in 10 months with a survival rate of 13%. Remote set spats of *Paphia malabarica* and *Pinctada fucata* showed higher growth rate in Ashtamudi lake.

The mabe pearl culture technology developed by the Institute was transferred to one SHG. New designs of images of mabe pearls were made at Andamans and a design for converting mabe-on-shell to a decorative table souvenir was finalized in consultation with local shell-craftsmen. Xenomorphism was evident in the pearl oyster stocks of Andamans due to constricted space in natural habitats. Training in mussel farming was imparted to the fishers in the state of Goa.

Nearly seven-fold increase in the production of seaweed *Kappaphycus alvarezii* in the Palk Bay, eleven-fold at Calicut and fifteen-fold at Navibunder were achieved. In the on-shore farming of this species in cement tanks along with swimming crab there was two-fold increase in weight. A total of 215 kg of *K. alvarezii* was harvested, when cultured for a period of 90 days in net bags in the sea off Narakkal, at Cochin.

Spawning and successful larval rearing of rabbitfish, *Siganus canaliculatus* was achieved for the first time. Seed production was standardized in 3 species of damsel fishes, while broodstock development and larval rearing of the blue green damsel was achieved for the first time in India. Success in the captive spawning of spine-cheek anemone fish *Premnas biaculeatus* was noteworthy. A total of 9500 seeds of clownfish were marketed during the year. Co-culturing of copepods in green water in the larviculture tank was shown to be the most effective larval rearing protocol for marine fishes. Rotifer enriched with *Chlorella salina* and *Nannochloropsis oculata* gave 45-68% larval survival in the clownfish *Amphiprion percula*. Few new strains of microalgae were isolated and maintained. Feeding intensity of blue damsel was high when green water system contained *Nannochloropsis*.

Open sea floating cages were installed at Visakhapatnam and Diu, and stocked with seeds of sea bass *Lates calcarifer*, air-lifted from the hatchery of Rajiv Gandhi Centre for Aquaculture at Sirkali, Tamil Nadu.

Biotechnology

Co-fermented tuna waste and vegetable discards increased amino acid content by about 24%. Fermented tuna waste exhibited more nutritional value when fed to clownfish species. Phytase and acid phosphatase enzymes were purified from crude extract of *Bacillus coagulans*. Triacylglycerol lipase was purified from *Pseudomonas fluorescence* by physical methods. Squilla meat had contrasting effect on the survival and growth rates of sexes in lobster and blue crabs, with females and males showing better results than by the opposite sex, respectively. Striped damsel weighing <200 mg fed with formulated feed with 362 g kg^1 protein content, showed maximum growth.

Biochemical characterization of 18 isolates of *Vibrio* collected from mariculture species was carried out. Two strains of *V. vulnificus* were pathogenic to Groupers at 10^6 cells/g, causing complete mortality within 6 days of

challenge. PCR diagnostics for detection of *Vibrio anguillarum* strains from the mariculture systems was developed. Dichloromethane extract from *Hypnea musciformis* showed high antibacterial activity. Out of 80 field samples of farmed shrimp, *P. monodon* tested for WSSV using histopathology, 72 tested positive whereas a large number of samples gave false negative with PCR. This result highlights the need for validation of PCR results, especially in preserved samples.

Sheared Principal Component Analysis and Discriminant Function analysis of truss morphometric landmarks Bombayduck (*Harpadon nehereus*) samples from Northwest and Northeast coasts indicated their stock differences. Preliminary analysis of mtDNA 16S rRNA sequences of the same species showed haplotype differences between the two coasts. Species-diagnostic RAPD bands were generated in 5 species of rock lobsters and 2 species of scyllarid losbsters.

Extension and Economics

Marine fishery resources such as sharks, rockcods, snappers, pomfrets, and crabs maintained steady whole sale and retail prices throughout the year due to high consumer preference. These resources also earned over 50% of the consumer rupee to the producer. There was a marked increase in value of marine fish landings this year compared to the previous year. Shrimps and cephalopods contributed to >50% of income generated from fisheries.

The capital productivity was highest in Andhra Pradesh and the labour productivity in Kerala. Factor productivity analysis undertaken for the input-output data collected from the trawlers of Andhra Pradesh and Kerala indicated positive signals in terms of both labour and capital productivity. Multiday fishing supported maximum the livelihood of fishers. Fisher community of Andhra Pradesh, Tamil Nadu, Orissa, West Bengal, Karnataka, Gujarat and Maharashtra supported monsoon fishing ban, while 50% of the mechanized sector of Kerala expressed their objection. About 30% of the fisher household members were engaged in non-fishery activities during the fishing ban period.

In an impact assessment study of mussel farming in the Korapuzha estuary, Calicut, the technology was observed to face negative externalities, such as clash of interest from the stake net fishers as well as spiraling cost of seed material.

The Agricultural Technology Information Centre (ATIC) of the Institute generated a total income of Rs. 1,10,247/- during the reporting year. Sale of microalgal inoculum and ornamental fish feed were among the major contributors to this income.

Publications, New projects & Recognitions

The Institute staff had published a total of 49 peer-reviewed papers, 17 popular articles, 67 technical articles and 11 papers in symposia/seminars. The Institute has published 1 bulletin and 5 special publications during 2006-07. A new ICAR network project on impact of fisheries research in India was approved during the year. The Institute won the Best ICAR Annual Report Award for the year 2004-2005. The Institute special publication *Matsyagandha* won the *Ganesh Sankar Vidyarthi Award* of ICAR for the year 2004 -2005.

Consultancy Services

Consultancy services provided to different agencies such as KIDS, KIOCL, NEERI and GMR Energy Ltd., generated Rs. 16.89 lakhs during 2006-07.

Training & Education

Under the education programme, 4 regular students and project SRFs were awarded Ph.D degree during 2006. Four students have been awarded degree by CIFE (Deemed University). KVK conducted a total of 75 courses in addition to some front line demonstration and on farm testing programmes.

Revenue generation

The Institute generated total revenue of Rs. 115.18 lakhs.

INTRODUCTION

The marine fisheries sector in the country contributes about 45% of the total fish production and is one of the major contributors to foreign exchange earnings through seafood export. The phenomenal growth in marine fisheries during the last two decades was due to the introduction of innovative fishing practices, well-developed harvest and post harvest infrastructure and increased demand for marine fish products both in domestic and export markets. However, the annual fish production has almost remained static since 1997 when the production reached 2.97 million tonnes. The resource monitoring programme of the institute show that there is a general decline in resource availability as evidenced by decline in catches and catch rate and incidence of large proportion of juveniles and young fish in the landings and decrease in average length at capture of many of the targeted species. Considerable volume of discards of non-target edible fishes by the multiday trawlers is also a serious concern. Excessive trawling was also found to adversely affect the biodiversity and ecosystem productivity, which would negatively impact the fish production.

It has now been realised that one of the possibilities of increasing marine fish production is by exploiting oceanic resources. There are a couple of under-exploited resources such as oceanic tunas with an estimated potential of about 2.78 lakh tonnes. During the past couple of years harvesting of oceanic tunas has increased substantially both by indigenous and mechanized fishing crafts. The potential of increasing fish production by exploitation of tuna resources from the two island ecosystems is also high, which needs to be given the highest priority. The road maps prepared by CMFRI for Andaman & Nicobar and Lakshadweep fisheries development will help in achieving the objectives. The potential for enhancement of fish production through large-scale ecofriendly open sea mariculture is also enormous. Management of the complex problems in marine fisheries is to be based on scientific principles and innovative research and the R & D efforts of CMFRI has been addressing these issues by undertaking need-based and solution-oriented research.

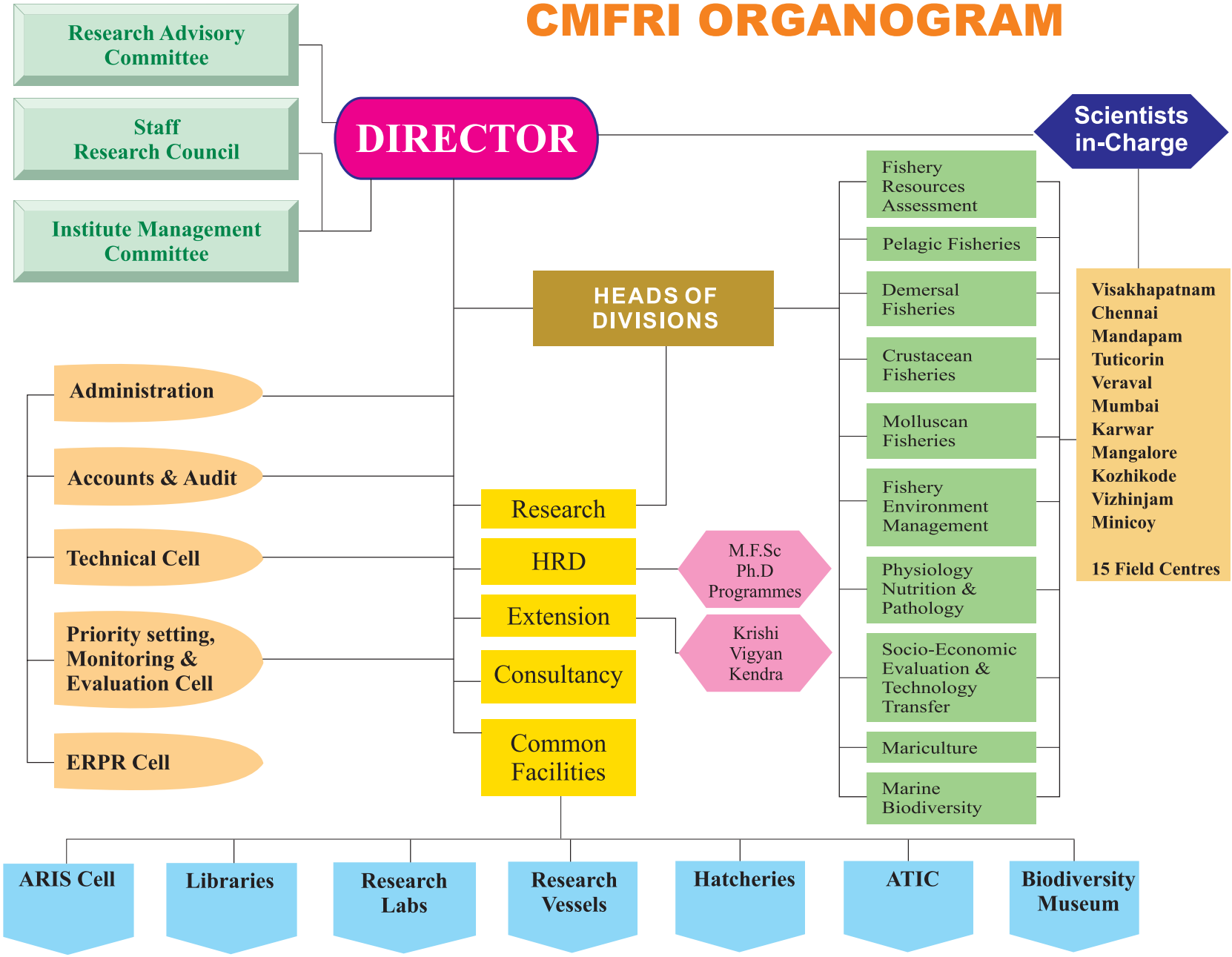
The Central Marine Fisheries Research Institute, which is celebrating the Diamond Jubilee of establishing the Institute in 1947 grew significantly in size and stature during the last 59 years by building up a fairly adequate research infrastructure and technically competent scientific man-power. The institute's multidisciplinary approach to research in marine capture and culture fisheries has won the recognition as a premier institute comparable to any well-established marine fisheries laboratory in the world.

To accomplish its mandate, the Institute monitors the marine fish landings from all along the country's coast from a regional perspective, conducts researches on characteristics of exploited marine fish stocks and impact of trawling on marine ecosystems, develops hatchery production technology and seafarming techniques, undertakes research in

The Mandate

- *To undertake basic, strategic and applied research in marine fisheries and mariculture.*
- *To monitor and assess the fisheries resources of the Exclusive Economic Zone (EEZ) and to understand the stock and its dynamics in relation to environment and human interventions.*
- *To develop and commercialize hatchery and production system technologies for finfish, shellfish and other commercial marine organisms in coastal and open seas.*
- *To build up database on marine biodiversity, carry out research on fragile marine ecosystems for their conservation and restoration.*
- *To undertake research on utilization of potentially beneficial marine organisms.*
- *To act as a repository of information on marine fishery resources with a systematic and analytical database for policy interventions and to carry out research on social and economic costs and benefits of marine fisheries.*
- *To conduct front line demonstrations and training to develop human resource for R & D in capture fisheries and mariculture.*
- *To create awareness and provide training and consultancy services.*

CMFRI ORGANOGRAM



environmental characteristics of inshore sea and studies on marine biodiversity. Studies are also conducted on economics of fishery enterprises, socio-economic conditions of fisherfolk and co-management of fishery resources through participatory approach.

The organisational set-up

To effectively carry out these tasks, the Institute has established Regional Centres at Mandapam Camp, Veraval and Visakhapatnam, Research Centres at Minicoy, Mumbai, Karwar, Mangalore, Kozhikode, Vizhinjam, Tuticorin and Chennai and 15 Field Centres all along the coast. The entire activity is coordinated by the Headquarters at Cochin. The Institute has, over the years, built up laboratory, hatchery and farm facilities for carrying out research programmes and has been upgrading the same to meet the changing needs and additional requirements. The sanctioned staff strength of the Institute is: Scientific 189, Technical 330, Administrative 150, Auxiliary 6 and Supporting 262.

The multidisciplinary researches in capture and culture fisheries are conducted under ten Divisions: Fisheries Resources Assessment, Pelagic Fisheries, Demersal Fisheries, Crustacean Fisheries, Molluscan Fisheries, Fishery Environment Management, Physiology, Nutrition and Pathology, Socio-economic Evaluation and Technology Transfer, Mariculture and Marine Biodiversity. Interdivisional and interinstitutional programmes are carried out for greater utililisation of expertise and facilities. Besides, the Institute also takes up short-term research projects on important and priority areas through ad hoc research projects funded by outside agencies in the country and abroad, and offers consultancy services to the clients from Government organisations as well as private industry.

Under the Postgraduate Programme in mariculture, the Institute organizes M.F.Sc and Ph.D programmes of the Central Institute of Fisheries Education, Mumbai, a Deemed University under the ICAR. The teaching programmes are carried out by the scientists of the Institute.

The Krishi Vigyan Kendra imparts training in mariculture, agriculture, animal husbandry and other related subjects to fish farmers, agricultural farmers and farm women.

The Library and Documentation Section provides reference facilities to research staff and students of the Institute as well as to visiting scientists both within and outside the country. The implementation of Hindi as Official Language is carried out by the Official Language Implementation Cell (OLIC).

The results of research carried out in the Institute are published in various journals. Besides, the Institute brings out Bulletins, Special Publications, Quarterly Newsletter and the Marine Fisheries Information Service and publishes the Indian Journal of Fisheries.

Staff strength as on 31.03.2007 including KVK, Narakkal

Category	Sanctioned	Filled	Vacant
RMP	1	1	-
Scientific	189 *	112	77
Technical	330	310	20
Administrative	150	144	6
Supporting	262	225	37
Auxiliary	6	5	1
Total	938	797	141

* Revised to 173 and formal approval for the same is awaited from the Council.

Budget 2006 – 2007

The budget allocation and expenditure details under Non-Plan and Plan for the financial year 2006-07

(Rs. in lakhs)

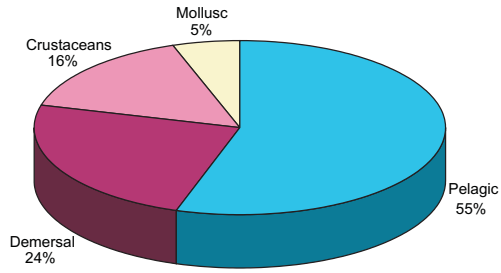
Sl. No	Sub Head	RE 2006-07	Expenditure for 2006-07
NON PLAN			
1	Estt. Charges	1612.55	1612.55
2	O.T.A.	1.10	1.10
3	T.A	23.40	23.40
4	Other Charges	429.95	429.95
5	Works		
	a) Office Building	154.43	154.43
	b) Residential Building	39.57	39.57
	c) Minor Works	3.00	3.00
6	Other Items	0.00	0.00
	TOTAL	**2264.00**	**2264.00**
		PLAN	
1	Estt. Charges	-	-
2	T.A.	21.00	21.00
3	Other Charges		
	a) Contingency	201.27	201.27
	b) Equipment	25.00	25.00
	c) Library	35.50	35.50
	d) Information Technology	7.00	7.00
4	Works		
	1. Works as per EFC		
	a) Special Repairs	187.50	187.50
	b) Major works		
	2. One time Catch-up-grant		
5.	a) Other items *	9.53	9.53
	b) HRD *	6.22	6.22
6.	N.E.H.	NIL	NIL
	TOTAL	**493.02**	**493.02**

Marine Capture Fisheries

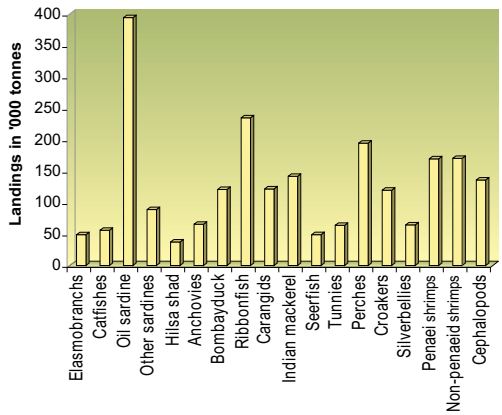
PROJECT CODE FRA/ASSESS/01
PROJECT TITLE **Assessment of exploited marine fishery resources**
SCIENTISTS **M. Srinath,** T.V. Sathianandan, J.Jayasankar, Wilson T. Mathew and Somy Kuriakose
CENTRES Cochin and Chennai

This project aims at estimating the marine fish landings and fishing effort in different regions of the country with resource-wise and gear-wise break up of the exploited resources. The project maintains the database on marine fish landings in India achieved at the Institute. A multistage stratified random sampling design was employed to collect and estimate the landings of the exploited marine fishery resources. The work involved planning, execution and co-ordination of field work, processing of data and updating database and developing suitable formats for storage and retrieval.

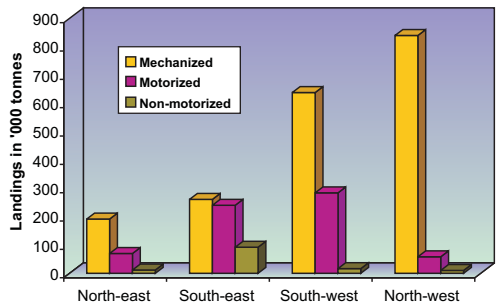
- Among the commercially important groups, landings of oil sardine, ribbonfishes, lesser sardines, cephalopods, and seerfishes recorded increase and croakers recorded marginal increase while there was a slight decrease in the landings in 'Bombayduck' and penaeid shrimps.
- The region-wise estimated fish production showed that the north-east region, comprising West Bengal and Orissa coasts contributed 10.1% to the total production. South-east region consisting of Andhra Pradesh, Tamilnadu and Pondicherry coasts contributed 21.8%. On the west coast, south-west region comprising Kerala, Karnataka and Goa coasts recorded 34.6% of the total, whereas, the north-west region comprising Maharashtra and Gujarat coasts accounted for 33.5 %.
- Oil sardine landings recorded 3.94 lakh tonnes during the year 2006 registering 17.8% increase over the previous year.
- The landings of ribbonfishes and non-penaeid shrimps recorded a significant increase of about 1.2 lakh tonnes and 49 thousand tonnes, respectively when compared to that of the previous year.
- The 'Bombayduck' landings showed a marginal decline of about 2,000 tonnes with an estimate of 1.2 lakh tonnes during 2006.
- The landing of croakers during 2006 was 1.19 lakh tonnes with an increase of 4,000 tonnes over the previous year.
- A decline of 3,000 tonnes was observed in the landing of penaeid shrimps, with the estimate of 1.69 lakh tonnes during 2006.
- The landing of perches and Indian mackerel increased about 38,000 tonnes and 24,000 tonnes, respectively when compared to the previous year.
- Cephalopod landings recorded an increase of about 38,000 tonnes during the year 2006 with an estimate of 1.35 lakh tonnes.
- The landing of carangids was 1.21 lakh tonnes with a decrease of about 21,000 tonnes.



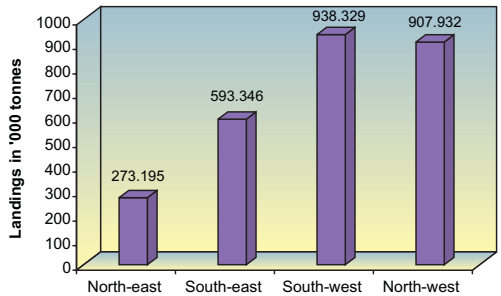
Components of marine fish landings in India during 2006



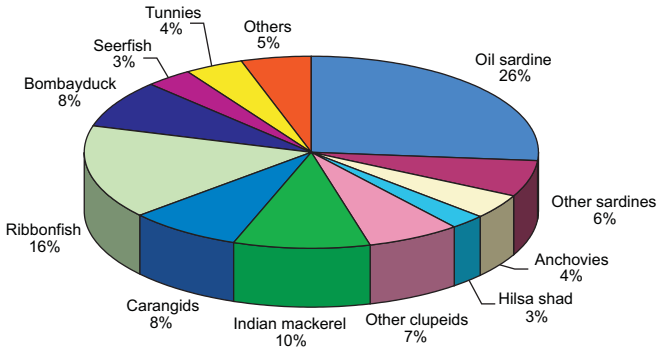
Landings of major fishery resources during 2006



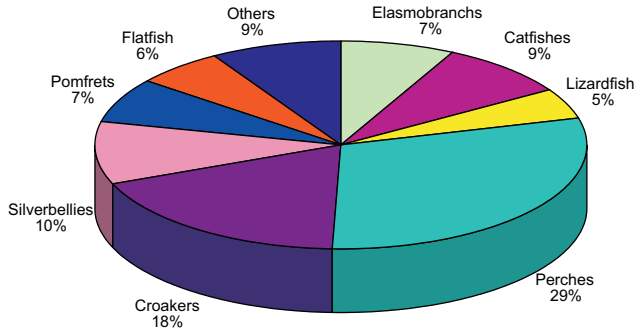
Sector-wise landings in different regions, 2006



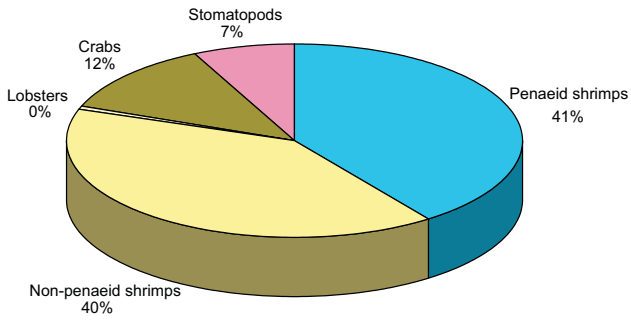
Region-wise landings in India, 2006



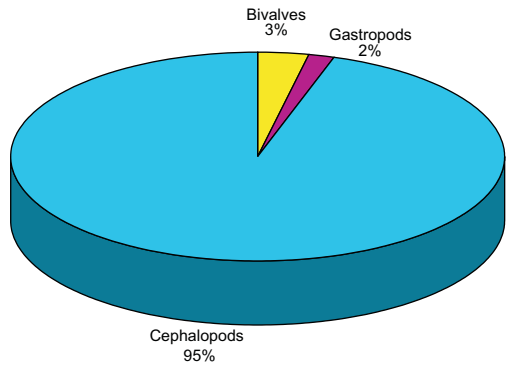
Components of pelagic finfish landings, 2006



Components of demersal finfish landings, 2006



Components of crustacean landings, 2006



Components of molluscan landings, 2006

Estimated Marine fish landings (t) during 2005 and 2006*

Pelagic finfishes			Demersal finfishes		
Name of fish	**2005**	**2006**	**Name of fish**	**2005**	**2006**
CLUPEOIDS			ELASMOBRANCHS		
Wolf herring	14652	15818	Sharks	26139	27368
Oil sardine	334862	394598	Skates	3249	3018
Other sardines	69129	89041	Rays	16940	18566
Hilsa shad	32004	37372	EELS	8548	10201
Other shads	5781	10662	CATFISHES	45422	56073
Coilia sp.	33760	29392	LIZARDFISHES	30543	30311
Setipinna sp.	5090	3596	PERCHES		
Stolephorus spp.	27860	32704	Rock cods	18468	22168
Thryssa spp.	41262	31972	Snappers	5732	4451
Other clupeoids	39944	41063	Pigface breams	9569	11009
BOMBAYDUCK	122353	120998	Threadfin breams	88367	111345
HALFBEAKS & FULL			Other perches	34609	45804
BEAKS	2553	4070	GOATFISHES	17053	16394
FLYING FISHES	917	949	THREADFINS	8839	7549
RIBBONFISHES	114115	235084	SCIAENIDS	115537	119857
CARANGIDS			SILVERBELLIES	58846	64633
Horsemackerel	29850	24901	WHITEFISH	3281	5092
Scads	54438	39409	POMFRETS		
Leatherjackets	9914	8474	Black pomfret	14812	15191
Other carangids	48754	49079	Silver pomfret	25969	25381
MACKERELS			Chinese pomfret	4001	3379
Indian mackerel	125424	141918	FLATFISHES		
Other mackerels	0	1	Indian Halibut	1107	1328
SEERFISHES			Flounders	119	32
Scomberomorus			Soles	34733	37546
commerson	28107	38398	MISCELLANEOUS	16931	16999
S. guttatus	12271	10644	**Total**	**588814**	**653695**
S. lineolatus	0	6	**Shellfishes**		
Acanthocybium spp.	199	41	CRUSTACEANS		
TUNAS			Penaeid shrimps	172099	169741
Euthynnus affinis	22186	30607	Non-penaeid shrimps	121107	170564
Auxis spp	5786	16175	Lobsters	1201	1569
Katsuwonus pelamis	1615	3330	Crabs	37182	50929
Thunnus tonggol	4515	6115	Stomatopods	21187	30551
Other tunas	5825	7779	MOLLUSCS		
BILLFISHES	2967	4397	Cephalopods	97069	136032
BARRACUDAS	15854	17751	Miscellaneous	1488	6957
MULLETS	6542	6905			
UNICORN COD	716	695			
MISCELLANEOUS	36098	38820			
Total	**1255342.556**	**1492763.548**	**Total**	**451333**	**566343**
			Grand total	**2295490**	**2712802**

* Provisional estimates for 2006

Salient findings

- *The marine fish landing of India during the year 2006 has been estimated as 2.71 million tonnes, which recorded an increase of about 4.1 lakh tonnes against the estimate of the previous year.*
- *The pelagic finfishes constituted 55%, demersal fishes 24%, crustaceans 16% and molluscs 5% of the total landings.*
- *The sector-wise contribution of marine fish landings during the year 2006 were mechanized landings 71%, motorized landings 24% and the artisanal landings 5% .*

- The database on landing of exploited marine fishery resources maintained by the Institute has been updated with current estimates of 2006.

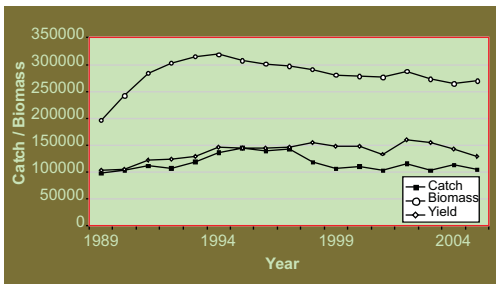
PROJECT CODE **FRA/ASSESS/02**

PROJECT TITLE **Stock assessment techniques for exploited marine fish and shellfish resources**

SCIENTISTS **T.V. Sathianandan,** M. Srinath, J. Jayasankar, Somy Kuriakose and Wilson T. Mathew

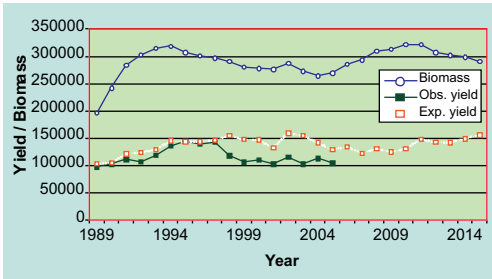
CENTRES Chennai and Cochin

The project aims at reviewing the existing methodology for stock assessment, develop methods suitable to the tropical multi-species and multi-gear systems and developing software for fish stock assessment.



Surplus production model fitted to demersal resources of Tamilnadu

- Software modules for simulation of fishery using catch and effort data were bundled together to form a console application: Initial parameter estimator, final parameter estimator through genetic algorithm, spectral forecast for effort and simulation of future time series sequences on effort, fishing mortality, biomass and yield under different management measures.
- Estimates of parameters of surplus production models and spectral models were made for demersal fishery in Tamilnadu using catch and effort time series.
- 1000 simulations of effort series were made and for each series, fishing mortality, biomass and yield were calculated using surplus production model.
- Management options were applied on the fishery by controlling the effort series with a suitable multiplication factor.
- Simulation of fishery from 2005 to 2014 were made for 6 different management options for trawl net fishery and gillnet fishery of Kerala using estimates of surplus production model and spectral model.
- Software was developed in Visual Basic with Access backend for age-based Thompson and Bell model analysis, Schaefer and Fox model and estimation of MSY using Gulland's and Cadima's formula, estimation of relative catch per unit effort and normalised relative effort.



Simulated demersal catch for Tamilnadu at present level of exploitation

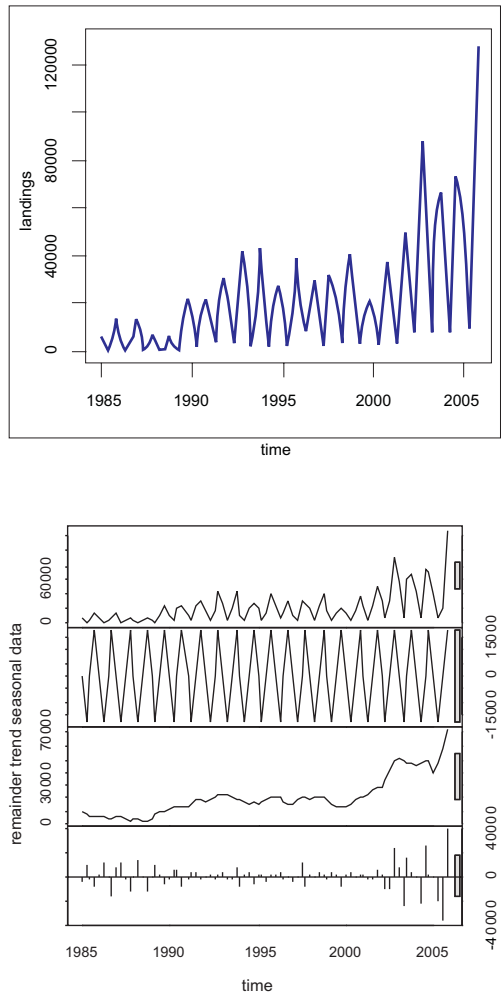
Predicted change in average yield (percent compared to 2001-05) of demersal fishes in Tamilnadu at varying effort levels

Period	Effort level							
	25%	50%	75%	100%	125%	150%	175%	200%
2006-10	-70.94	-46.48	-26.51	-10.69	0.98	8.95	13.55	15.15
2011-15	-63.16	-33.87	-12.08	2.56	10.10	11.03	5.89	-4.37
2006-15	-67.05	-40.18	-19.29	-4.07	5.54	9.99	9.72	5.39

PROJECT CODE	**FRAD/IDP/01**
PROJECT TITLE	**Appraisal of marine fisheries of West Bengal**
SCIENTISTS	**M. Srinath,** J. Jayasankar and Somy Kuriakose
CENTRE	Cochin

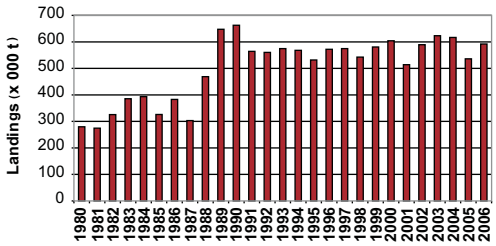
This project aims at assessing the marine fisheries of West Bengal by means of sustained periodic planned collection of catch and effort data and development of macro-paradigms explaining the trend and sustainability. The district-wise, quarter-wise, gear-wise and species-wise landings from 1986-2005 formed the data base for the project.

- Annual landings of West Bengal ranged between 158,534 tonnes and 197,424 tonnes between 2002-2006. The maximum was in 2005 and minimum in 2002.
- In West Bengal, fishing season starts from June and ends with February. Maximum landings was during the fourth quarter (44%) and the minimum was during the second quarter (3%).
- Trawlers and gill-netters were the major crafts. The engine power of trawlers ranged between 80 and 250 HP and that of gill-netters between 65 and 120 HP. Length of trawlers varied between 27.4 and 57.9 m and that of gill-netters between 21.3 and 51.8 m. Both the crafts were deployed for multiday fishing and single day fishing units and their catches were showing a decreasing trend.
- The major gears were trawlnets, gillnets, bagnets and hooks & lines. Seasonal landings by shoreseines, stakenets and boatseines were noticed.
- Trawlnet landing were on the decline, whereas gillnet landings were increasing. Bagnet landing keeps a trend of crests and troughs.
- About 19% of the total landing was by trawlnets, 43% by gillnets and 36% by bagnets and the remaining 2% was by hooks & lines and shoreseine.
- Mechanized sector showed improvement over the motorized sector whereas non-mechanized sector kept the same rate of exploitation during the last five years.
- Major resources landed in West Bengal during 2006 are 'Bombayduck' (20%), hilsa shad (20%), non-penaeid shrimps (11%), pomfrets (7%), catfishes (6%), croakers (6%) and penaeid shrimps (3%). Bombayduck and non-penaeid shrimps were caught by bagnets.
- Exploitation of catfishes, pomfrets and hilsa shad were maximum by gillnets. Penaeid shrimps and croakers were mainly landed by trawlnets.
- During 2002 and 2003, both the districts of West Bengal- 24 Parganas and Midnapur - contributed equally to the state fishery. From 2004 onwards, due to increased mechanization in 24 Parganas district, the landings crossed 80% of the total landings of the State and in Midnapur district it is less than 20%.
- ARIMA models were used to forecast the marine fish landings of West Bengal.

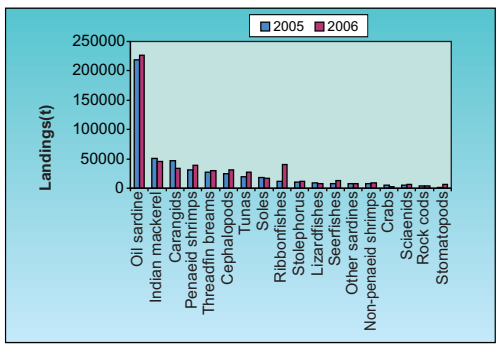


Total fish landings in West Bengal

PROJECT CODE	**PEL/IDP/01**
PROJECT TITLE	**Appraisal of marine fisheries of Kerala**
SCIENTISTS	**N. G. K. Pillai,** A. A. Jayaprakash, U. Ganga, K. K. Appukuttan, T. S. Velayudhan, K. S. Mohamed, Mary. K. Manisseri, E. V. Radhakrishnan, G. Nandakumar, E. Vivekanandan, S. Sivakami, Rekha Devi Chakraborty, N. G. Menon, C. Ramachandran, Somy Kuriakose, P. T. Sarada, P. Laxmilatha, P. N. Radhakrishnan Nair, M. Sivadas, P. P. Manoj Kumar, K. K. Philipose, Grace Mathew, M. K. Anil and Leela Edwin (CIFT)
CENTRES	Cochin, Calicut and Vizhinjam



Marine fish landings of Kerala 1980-2006

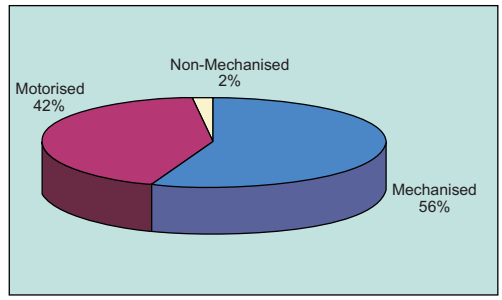


Landings of major fishery resources of Kerala during 2005 and 2006

Marine fish landing trends in Kerala during 2006

- The estimated marine fish landings of Kerala during 2006 was 5.92 lakh t. It showed an increase of 10% over that of 2005. Landings were also higher than the annual average (1988-2005) catch of 5.74 lakh t. Among finfishes, pelagic resources accounted for 71% and demersals 14%. Crustacean resources accounted for 10% while cephalopods formed 5%.
- Pelagic resources were mainly constituted by oil sardine (2.3 lakh t), mackerel (45000 t), ribbonfishes (41000 t), carangids (33300 t), tunas (27843 t) and seerfishes (12700 t). Demersal resources were dominated by threadfin breams and soles. Among crustaceans, penaeid shrimps were dominant (39000 t). Cephalopods, mainly squids and cuttlefishes, contributed 31200 t.
- Mechanized (in-board engines) and motorized sector (out-board engines) contributed 56% and 42%, respectively while traditional sector accounted for 2% of the total landing. In the mechanized/ motorized sector, among various gears, ring seines (RS) contributed 49%, trawls 33%, drift gill nets and hooks & line 18%.
- Districtwise landings: Kollam (18%), Kozhikode (17%), Thrissur (16%), Ernakulam (12%), Trivandrum and Malappuram (10% each) and rest from the other districts such as Alappuzha, Kannur and Kasargod.
- Quarterwise, landings were highest in the 4th quarter (31%), followed by 3rd quarter (25%) and the first and second quarters which contributed 22% each.
- Ring seine (RS) landings (2.85 lakh t) were dominated by the pelagics such as oil sardine, mackerel and small carangids mainly scads. In outboard RS units (motorized sector) oil sardine, scads and penaeid shrimps dominated the landings, whereas in the inboard RS units (mechanized sector) landings were dominated by mackerel, lesser sardines, coastal tunas, juvenile seerfishes, ribbonfishes and larger of carangids.
- Trawls contributed 1.92 lakh t (33%) with landings dominated by penaeid shrimps, cephalopods, threadfin breams, ribbonfishes, lizardfishes, anchovies and elasmobranchs.
- Size of trawlers currently operating off Kerala ranged from 7.8 to 21.2 m LOA with 96 HP to176 HP installed engines. Duration of fishing trips ranged from 4 to 12 days and onboard crew consisted of 6 to 8 members.

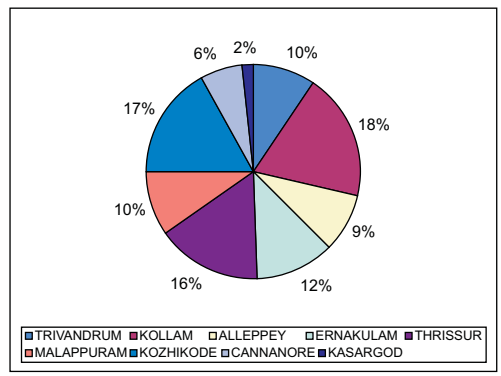
- Among the important groups, oil sardine, whitebaits, ribbonfishes, pomfrets, billfishes, sciaenids, rock cods, tunas, seerfish, cephalopods and penaeid shrimps recorded an increase in the landings compared to 2005.
- Growth, mortality parameters and exploitation rates (E) were estimated for major pelagics (7 groups, 13 species), demersals (3 groups, 5 species), molluscs (2 groups, 3 species) and crustaceans (2 groups, 8 species) of commercial importance.
- The Long Term Potential Yield (LPTY) of marine fish landings of Kerala was estimated as 6.63 lakh t and the Average Long Term Yield (ALTY) as 6.25 lakh t.



Sector-wise marine fish landings of Kerala during 2006

Longterm Potential Yield (LPTY) and Average Long Term Yield (ALTY) of fish resources along Kerala coast

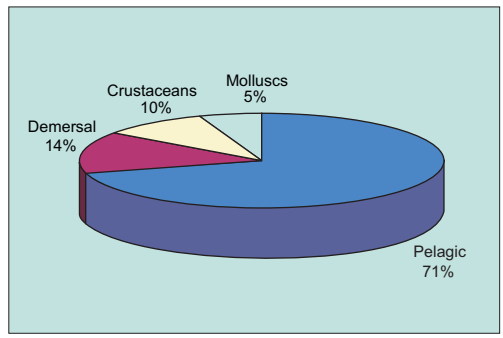
Resource	LPTY (t)	ALTY (t)
Oil Sardine	264372	236182
Mackerel	128411	106250
Penaeid shrimps	71871	57894
Seer fishes	10162	7862
Cephalopods	43472	37658
Tunas	32615	22671
Silverbellies	6887	6176
Elasmobranchs	6968	6136
Lizard fishes	14126	13341
Rock cods	9386	6822
Snappers	2482	2066
Threadfin breams	55078	45163
Other perches	16488	13640
Sciaenids	17720	15665
Soles	27301	22802
Total	**662890**	**624859**



District-wise marine fish landings of Kerala during 2006

Pelagic finfish resources

- Oil sardine landings estimated at 2,26268 t show an increase of 3% over the last year (2,24,706 t). Ring seine was the major gear employed and 92-172 mm size groups dominated landings. Juveniles and pre-adults in ring seines (outboard) at Alleppey constituted 52% (18% over last year) and 73% at Calicut. However, the contribution of juveniles and pre-adults in the inboard ring seines was only 22% of total catch. Exploitation was at MSY level.
- Dry fish trade using juvenile sardines was estimated at 3700 t worth Rs. 4.06 crores at Alleppey and around 5000 t worth Rs.6.5 crores at Calicut.
- Mackerel landings were estimated at 45103 t and showed a decline of 11%. Ring seines contributed (72%) followed by drift gill nets (20%), hooks and lines (5%) and trawls (3%). The catch per unit hour (CPUH) for mackerel was 0.7kg (trawl), 3.5 kg (mechanized gill net), 1.6 kg (hooks & line) and 98 kg (ring seine).
- In the ring seine landings of North Kerala, size range of oilsardine was 105 –260 mm with a mean size of 189 mm.



Major components of marine fish landings in Kerala during 2006

Inboard ringseiner along the Malabar coast

- Length range of mackerel in South Kerala was 180 –285 mm. The length at first capture (Lc) was 134 mm. Exploitation rate (E) was 0.6 while the spawning stock constituted 66% of the standing stock biomass.
- Mackerel landings were at the Maximum Economic Yield (MEY) level. While present level of fishing can be continued, further increase in effort is not desirable.
- Carangid landings were estimated as 33304t with a decrease of 29% compared to previous year. Major species landed were *Megalaspis cordyla*, *Decapterus russelli* and *Selar crumenopthalmus*. Exploitation was optimum.
- Whitebaits, a multispecies resource with estimated landing of 15,569 t, formed 4% of the pelagic finfish landings and showed an increase of 5% compared to last year.
- Along the Malabar coast, anchovies were landed mainly by trawl net (47%) and ring net (44%) and catch rates were 0.5 kg /hour and 10.3 kg /unit effort, respectively. *Encrasicholina devisii* was the major species (54.3%) followed by *S.bataviensis* (25%) and *S. macrops* (12%).
- Growth parameters and exploitation rate (E) of *E. devisi* estimated was L_{α}110 mm, K= 1.6 and E= 0.74 while standing stock and spawning stock biomass was 2510 t and 1641 t, respectively.
- The landings of ribbonfish (*Trichiurus lepturus)* during 2006 were unusually high being an estimated 44,848 t which was nearly 4 times higher than that in 2005. Districtwise, landings were mainly from Quilon (35%) followed by Kozhikode (25%) and Ernakulam (19%).
- Trawl net was the major gear contributing 55% of the ribbon fish landings followed by boat seine (33%). The peak fishery season was during monsoon and post monsoon periods (3rd & 4th quarters) when 94% of the annual catch was landed. The size range of *T. lepturus* was 32-104 cm with fishery dominant groups in the size range 56-84 cm and mean length (ML) at 63.1cm. L_m was 46 cm. The growth and mortality parameters were estimated as L" = 120cm, K= 0.74; Z= 5.02, F= 4.04, M= 0.98 and exploitation rate (E) 0.8. The spawning stock biomass and the standing stock biomass were 30,166 t and 35,516 t, respectively.

Outboard gill net units along the Malabar coast

- Tuna landings (27,843 t) showed an increase of 42% compared to 2005 (19,571 t). *Euthynnus affinis* (41%) dominated the catch followed by *Auxis* spp. (39%) and *Thunnus albacares* (10%). Mechanised gill nets contributed 45% of the tuna landings, followed by hooks and line (36.5%) and ring seines(18%).
- The size range of yellowfin tuna was 40-186 cm but fishery groups that dominated were 50-96 cm constituting 76% of the catch. Skipjack tuna of size range 38 –86 cm were landed with the dominant size group 48 –62 cm fork length (FL).
- Exploitation rate (E) for coastal tunas (*A. thazard* and *E. affinis*) was 0.6. Compared to the previous year, E of oceanic skipjack was

constant at 0.7, while for yellowfin it was comparatively low (0.4). Spawning stock of yellowfin during 2006 constituted 71% of the total standing stock and was 180% higher than 2005 values.

Fishery related parameters of some important pelagics

Species	Length range (mm)	Mean size (mm)	Fishery dominant size group (mm)	Exploitation rate (E)	Standing stock biomass (t)	Spawning stock (%)
Sardinella longiceps	70-200	126	140-180	0.5	279069	40
Rastrelliger kanagurta	85-280 189 (RS)	173 (trawl)	160 -190	0.6	524970	73
Stolephorus commersonii	60-145	105	90-110	0.6	3234	45
Stolephorus macrops	55-100	73	70-90	0.8	873	49
Encrasicholina devisi	55-145	85	80-110	0.7	2510	65
Euthynnus affinis	300-640*	460	380 -520	0.6	16180	69
Auxis thazard	220-500*	360	300-400	0.6	20340	76
Katsuwonus pelamis	380-860*	520	480-620	0.7	2362	93
Thunnus albacares	400-1860*	820	500-960	0.4	5520	71
Decapterus russelli	140-240	215	175 -220	0.6	50770	90
Megalaspis cordyla	190 -385	277	240 -360	0.5	5932	70
Trichiurus lepturus	320-1040	631	560-840	0.8	30166	98
*Scomberomorus commerson**	320-980	590	480-660	0.6	3326	10

*Fork length (FL)

- Seerfish landings showed increase of 72% compared to 2005. Gillnets contributed 77% and ring seines, 12%. Size range of seerfish was 32-98 cm with 56-64 cm size group dominating. Mean size indicated a decline (59 cm) compared to 63 cm in 2005.

Demersal finfish resources

- Elasmobranch landings of Kerala were estimated at 3283 t and showed marginal increase compared to 2005. Sharks, skates and rays formed 62%, 26% and 12%, respectively of the total elasmobranch landings.
- Trawl net contributed 45% of the elasmobranch landings, followed by gill net (41%) and hooks and line (10%). Highest catch rate was observed in gill nets and hooks and line, being 1.18 and 1 kg per unit effort, respectively.
- At Cochin Fisheries Harbour mechanized gillnets and hooks and line were the major gears. Fourteen species of sharks were recorded in the landings. In gillnet, longtail shark *Alopias supercilliosus* was dominant (42%) followed by *Carcharhinus limbatus* (24%) and *Sphyrna lewini* (15%). Mechanized vessels based at Cochin operated off Ratnagiri (Maharashtra) landed oceanic sharks such as thresher sharks *Centrophorus uyato*, *Alopias vulpinus* and the tiger shark *Galeocerdo cuvieri*. The devil ray *Mobula japanica* contributed 99.9% of the ray landings.
- At Calicut, carcharhinid sharks (*C. limbatus*, *C. melanopterus*, *C. sorrah*) contributed 76% followed by *S. zygaena* (17%). Among rays, *Dasyatis* spp. and *Aetobatus narinari* were dominant.

Finfish catches being sorted and packed at Neendakara Fisheries harbour

Heavy landings of ribbonfish at Cochin

- At Vizhinjam, shark landings (42%) were mainly by drift nets and comprised of carcharhinid species such as *C. melanopterus* (45.6 to 64.5 cm size), *C. dussumieri* (41.6 –64.2 cm) and *C.limbatus* (51.2 to 74 cm). Rays (*Dasyatis* spp.) contributed 58%.
- *C. limbatus* was the most dominant species. Standing Stock (SS) and Spawning Stock Biomass (SSB) was 2,886 t and 1,433 t, respectively. While the SSB was 62% of the standing stock, the high E and a declining trend in catch and catch rates observed for most of the elasmobranchs is indicating overexploitation.
- Threadfin breams that constitute the fishery were *Nemipterus japonicus* (47.8%), *N. mesoprion* (51.7%). Immature fishes dominated the catches of *N. japonicus* and *N . mesoprion*. The stock of *N. japonicus* and *N. mesoprion* are under intensive fishing pressure.
- Among soles, *Cynoglossus macrostomus* was dominant at Cochin Fisheries Harbour and Neendakara.
- Standing Stock and Spawning Stock Biomass along Kerala was 22,789 t and 11,769 t, respectively.
- Major gears that contributed to sciaenid landings were trawls (63%) and gill nets (24%). Catch rate in ring seines was 1.7 kg per unit effort compared to 2.9 kg in 2005.
- Sciaenid catch comprised of 8 species. In the trawl net landings at Cochin and Neendakara Fisheries Harbour, *Nibia maculata* was the dominant species (37%) followed by *Johnius glaucus* (18%) while at Calicut *J. sina* dominated (74%).
- Landings of groupers and snappers were an estimated 5443 t and showed an increase of 24% compared to previous year. Among groupers, *Epinephleus diacanthus* dominated the landings (79%) followed by *E. chlorostigma* at Cochin and Neendakara Fisheries Harbours.
- Trawl net was the major gear (99%) at Neendakara and size range of *E. diacanthus* was 120 – 320 mm at Cochin Fisheries Harbour and 90 – 320 mm at Neendakara Fisheries Harbour. At Vizhinjam, *E. chlorostigma* ranged in size from 181 –323 mm.
- Among lizardfishes, *Saurida tumbil* was the major species (58%) followed by *S.undosquamis* (40%). Spawning stock biomass of

Fishery related parameters of some important demersals

Species	Length range (mm)	Mean size (mm)	Fishery dominant size group (mm)	Exploitation rate (E)	Standing stock biomass (t)	Spawning stock (%)
Carcharhinus limbatus	800 -2000	1039 (TR) 918 (GN) 1510 (LL)	1000-1200 800-1000 1500-2000	0.7	2886	50
Nemipterus japonicus	64 -338	148	120-180	0.8	26570	79
Nemipterus mesoprion	62-269	134	100 -150	0.7	20053	74
Cynoglossus macrostomus	62-166	107	100-130	0.7	22789	52
Epinephelus diacanthus	90-320	170	120-190			
Johinus sina	55-199	132	120-150	0.7	11073	47

S.tumbil and *S.undosquamis* was 58% and 63% of the standing stock respectively. Fishing pressure on the two species were relatively high at 0.8 and 0.6, respectively. Bull's eye landings were mainly constituted by *Priacanthus hamrur* (94%).

Crustacean resources

- Crustacean landings composing of peneid and non-penaeid shrimps, crabs and stomatopods were estimated at 57595 t and showed an increase of 26% compared to 2005. Penaeid and non–penaeid shrimps comprised 68% and 15%, respectively of the crustacean landings followed by stomatopods (12%) and crabs (5%).
- The landings of penaeid shrimps in the state showed an increase of 24% with an estimate of 39011 t.
- At Calicut, 64% of the shrimps is landed by mechanised trawlers followed by ring seine (26%).
- Along the Malabar coast, of the 14 species landed, *Metapenaeus dobsoni* dominated (40%) followed by *Fenneropenaeus indicus* (23%), *Parapenaeopsis stylifera* (15%) and *M.monoceros* (11%). *F.indicus* was the dominant species and *P.stylifera* was in fourth place during 2005. The total mortality of shrimps was between 3.2 and 7.1. Prediction analysis using Thompson and Bell yield model indicated that the MEY levels for most of the shrimp species has been attained and further fishing effort has to be decreased.
- At Cochin, the inshore shrimp fishery was dominated by *P.stylifera* (42%) and *M. dobsoni* (39%). The deep sea shrimp fishery was constituted by pandalids (68%) and rest by penaeids. *Plesionika spinipes* (31%), *H.gibbosus* (18%) and *H.woodmasoni* were important pandalids and among penaeids, *M.andamenensis*. Size range of *H.gibbosus* was 61 –140 mm, *H.woodmasoni* 66-135 mm and *M.andamanensis* 61 –130 mm. Penaeid shrimps (*F. indicus, M. dobsoni, M. monoceros* and *P. stylifera*) had exploitation rates of 0.65-0.78 showing overexploitation indicating need for reduction in fishing pressure.
- The Slipper lobster *Thenus orientalis* catches decreased by 23% compared to previous year. Females in length range 96 -215 mm TL (mean 149 mm) and males 86 -200 mm (mean 138 mm) were observed. During September-October, berried females occurred. Deep sea lobster (*P.sewelli*) catch and catch rates showed increase.
- Lobster landings at Calicut were mainly by bottom-set-gill nets. *Panulirus homarus* dominated the fishery, mostly exploited live and sent to Chennai for export; Rs. 800/kg for size 200-350 g. 41-119 mm size groups dominated . Immature females dominated the fishery (59%).
- Crab landings declined by 43% compared to previous year. *Charybdis feriatus* (57%) dominated at Cochin and *Portunus sanguinolentus* (78%) at Calicut. At Calicut, 87% of the crab landings was by mechanised trawlers and 12% by indigenous trawlers. In trawl, *P.sanguinolentus* dominated (65%) followed by *Charybdis feriatus* (25%). The fishery of *C.feriatus* improved during 2006.

Bumper shrimp catch in a trawler at Neendakara Fisheries Harbour

Ribbonfish landing at Puthiyappa, Calicut

Molluscan resources

- Cephalopod catch in Kerala increased by 25% (31,203 t) and catch rate by 26%. Peak abundance was observed during June and August to October period. Spawning congregation of squids occurred during post-monsoon. The prominent species in the catch were *Sepia pharaonis* (49%) and *Loligo duvauceli* (30%). The SSB of *S. pharaonis*, was estimated as 55% of the standing stock biomass. The annual recruitment of the three species were 29, 12 and 25 million numbers, respectively.
- The total landings of cephalopods in the Malabar region (Kozhikode, Kannur, Kasargod, and Malappuram) were estimated at 7962 t with highest contribution by MDTN (84.4%) followed by MTN (8.1). The catch rate was 5.5 kg/h in MDTN and 28kg /unit in OBHL. *S aculeata* was the dominant species (36%) followed by *S. pharaonis* (19%).The size class contributing to the fishery of the squid *L. duvauceli* was 16-246 mm, with the mean size in the fishery being 96.8 mm.
- At Vizhinjam, the cephalopod fishery was mainly by hook and line and jigs and contributed mainly by cuttlefish *S. pharaonis* and squid *L. duvauceli*. FAD units were widely used for the fishing of *S. pharaonis*. Both the resources were underexploited (E= 0.1) and indicated scope for increase.
- The total bivalve production in the Malabar region (Kozhikode, Kannur, Mahe excluding Kasargod), was estimated at 15682 t. The green mussel *Perna viridis*, formed 90 % of the total bivalve production. The clams *Meretrix casta* and *Villorita cyprinoides* contributed 9%, and rest by the edible oyster, *Crassosstrea madrasensis*. The size range of *P. viridis* in the fishery was 16-97 mm with mean size 67mm.

Minimum Legal Size (MLS) of cephalopods for export recommended to MPEDA

Species	Mantle length (mm)	Total live weight (g)
Loligo duvauceli	80	25
Sepia pharaonis	115	150
Octopus membranaceous	45	15

Socio-economic and behavioural studies

- Conservation orientation was found to be above the mean across the three categories namely mechanized, motorized and traditional indicating a positive behavioural change that should be harnessed through more extension interventions by concerned agencies in the State.
- Constraint analysis revealed that fishermen crew and boat owners preferred to rank low first sale price as the greatest constraint followed by depletion in resource and high fuel cost. It is worth noting that depletion in resource was ranked high above the fuel cost. This indicates that if the State undertakes resource augmenting strategies it is more likely to be accepted by the fisherfolk.

Mesh selectivity studies

- Optimum mesh (diamond) sizes were determined for major species occurring in the trawl fishery. The selection factor for different species of finfish and shellfishes range from 2.12 to 4.2.

PROJECT CODE	**PEL/IDP/02**
PROJECT TITLE	**Appraisal of marine fisheries of Karnataka and Goa**
SCIENTISTS	**C. Muthiah**, N. Ramachandran, S. G. Raje, A. P. Dineshbabu, Geetha Sasikumar, P. S. Swathilekshmi, M. Srinath and Saly N. Thomas (CIFT)
CENTRES	Mangalore and Karwar

- During 2006, marine fish landings along Karnataka-Goa coast were estimated at 3,46,427 t contributing to 12.8% to the all-India marine fish catch. As compared to the previous year, the catch improved by 17%.

Marine fish landings in Karnataka

- In Karnataka, the catch during the year was estimated at 2,40,888 t, forming about 8.9% of total marine fish landing of India, as against 2,24,041 t recorded in 2005 and the average long-term yield (ALTY) of 2,10,322 t (1982-2006).
- The marine fish catch of Karnataka was valued at Rs.66, 045 lakhs.
- Marine fish production of Karnataka during first, second, third and fourth quarter were 29%, 19%, 17% and 35%, respectively.
- Major gears were purseseine (32.4%, C/E: 1,664 kg), multiday trawl (41.4%, C/hr: 41.8 kg) single day trawl (13.5%, C/hr: 37.4 kg), ringseine (6.6%, C/E: 1621 kg) and gillnet (3.8%).
- Pelagics dominated the landings (58%) followed by demersal finfish (22%), crustaceans (12%) and molluscs (7%).
- Among pelagics, the oilsardine *S. longiceps* was the most dominant (44%), followed by ribbonfish (20%), the Indian mackerel *Rastrelliger kanagurta* (15%), carangids (8%) and seerfish (3%).
- Among demersal fishes, threadfin breams (40%), flatfishes (14%), perches (13%) and lizardfishes (13%) were the major groups.
- The crustacean catch was constituted by the commercially important penaeid shrimps (39%), crabs (5.8%) and the stomatopods (55%).

Mangalore Fisheries Harbour

Marine fish landings in Goa

- In Goa, marine fish landing was estimated at 1, 05, 539 t, contributing to 3.9% to the total fish catch of the country. As compared to the previous year, the catch improved by about 48% in the State and the ALTY is estimated to be 96,065 t. The marine fish catch from the State was valued at Rs.24, 821 lakhs.
- The major gears were purseseine (73%, C/E: 2,786 kg), singleday trawl (12%, C/hr: 34.1 kg), multiday trawl (6%, C/hr: 25.8 kg) and gillnet (7.6%).
- Pelagics contributed 83.4%, demersals 13.5%, crustaceans 2.8% and molluscs 0.3%.
- Among pelagics, oilsardine (61.3%), mackerel (18.3%) and carangids (5.2%) were the major groups.
- Among demersals, perches (18.9%), silverbellies (17.8%) elasmobranchs (16.1%) and flatfishes (15.7%) were the dominant groups.
- Crustaceans were constituted by penaeid shrimps (73%), crabs (14.8%) and stomatopods (11.8%).
- Cephalopods (100%) solely constituted the molluscan catch.

Penaeid shrimp landing at Mangalore Fisheries Harbour

Seerfish landing at Mangalore Fisheries Harbour

Squid landing at Mangalore Fisheries Harbour

Pelagic fish resources

- An estimated 6,755 t of seerfish were caught along the Karnataka and Goa coast (Karnataka: 3,809 t; Goa: 2,946 t) as against the average long-term yield (ALTY) of 7,108 t. The landing shows an increasing trend. Drift gillnet was the main gear (59 %). *S. commerson* (95%) was the most dominant species.
- Tuna and billfish landings were estimated at 5,666 t (Karnataka: 2,381 t and Goa 3,285 t) as against the ALTY of 6,206 t. Catch showed an increasing trend during the past three years. The major gear was purseseine (68%). Dominant species were *E. affinis* (77%) in Karnataka and *A. thazard* (64%) in Goa. While *E. affinis* was overexploited, *A. thazard* was underexploited.
- The ribbonfish landing was estimated at 32,294 t (Karnataka: 28,744 t; Goa 3,550 t) which is the record figure for the region since 1982, as against the ALTY of 17,318 t. Trawl was the major gear (>90%). *T. lepturus* was the only species in the fishery. Exploitation level was above the maximum sustainable yield.
- The production of the Indian mackerel, *R. kanagurta* was estimated at 37,032 t (Karnataka:20,933 t; Goa 16,099 t) as compared to the ALTY of 81,268 t. As compared to last year, the production shot up by about 40%. Pureseine was the main gear (68% in Karnataka and 88% in Goa).
- Sardine landing also showed tremendous improvement over last year. The catch was estimated at 1, 20, 490 t (Karnataka: 66,106 t; Goa: 54,384 t) as against the ALTY of 99,344 t. Purseseine was the major gear (76% in Karnataka and 99% in Goa). *S. longiceps* dominated the landings (95% in Karnataka and 99% in Goa).
- Whitebait production exhibited a declining trend in 2006; the catch was estimated at 2, 221 t (Karnataka: 2,198 t, Goa: 23 t) as against the ALTY of 11,933 t. Major gears in Karnataka were purseseine (56%) and multiday trawl (41%). In Goa singleday trawl was the main gear (65%). *E. devisi* was the major species in purseseine (70%) and *S. waitei* in trawl (100%).

Stock parameters of major pelagic species along Karnataka-Goa coast during 2006

Species	Size at maturity (cm)	Optimum Length at capture	Fishing mortality rate	Exploitation rate	Spawning stock biomass (t)	Standing stock biomass (t)	Yield (t)
Rastrelliger kanagurta	17.5	19.56	4.9	0.7	14839	24710	31281
Sardinella longiceps	15.0	13.83	4.0	0.69	43445	145553	118303
Encrasicholina devisi	6.8	6.9	5.58	0.67	423	904	1738
Stolephorus waitei	8.0	6.78	5.1	0.66	312	554	379
Scomberomorus commerson	70.0	106.7	3.22	0.67	439	1009	2326
Euthynnus affinis	43.0	50.64	5.03	0.74	104	590	2011
Auxis thazard	30.5	30.7	1.31	0.41	1215	2243	2178
Trichiurus lepturus	60.0	87.59	4.59	0.73	8729	15583	29846

Demersal fish resources

- Landings of sharks and rays were estimated at 479 t and 135 t, respectively in Karnataka and 724 t and 1,573t in Goa. *Scoliodon laticaudus* was the dominant species among sharks and *Aetobatus narinari* among rays. Size-range of male *S. laticaudus* was 30-62 cm and female 26-64 cm. Average fecundity was 14 litters/ female.

- Threadfin bream landing in Karnataka-Goa was 22,101 t (Karnataka: 21,362 t; Goa: 739 t) as compared to the ALTY of 20,964 t. *N. mesoprion* (80%) and *N. japonicus* (20%) were the two major species.
- Whitefish *Lactarius lactarius* catch was 1,848 t (Karnataka: 1,440 t; Goa: 408 t) as compared to the ALTY of 3,066 t. This species was found to be exploited above the optimum level.
- Flatfish production was 9,609 t (Karnataka: 7,370 t; Goa: 2,239 t) as against the ALTY of 12,996 t. Trawl contributed 98% of the production. *C. macrostomus* (95%) was the most dominant species. This species was found to be exploited near optimum level.

Threadfin bream landing at Mangalore Fisheries Harbour

Crustacean resources

- Shrimp catch, which was declining since 2002, improved in 2006, whereas, crab catch showed a declining trend. Shrimp production was estimated at 13,273 t and 2,090 t, respectively as against the fishable potential of 22,803 t of shrimps and 4,885 t of crabs. Dominant species of shrimps were, *M. monoceros*, *M. dobsoni*, *P. stylifera* and *Solenocera choprai* and that of crabs were, *P. pelagicus* and *P. sanguinolentus*.

Stock parameters of dominant demersal finfish species in Karnataka-Goa (2006)

Species	Size at maturity (cm)	Optimum Length at capture	Fishing mortality rate	Exploitation rate	Spawning stock biomass (t)	Standing stock biomass(t)	Yield(t)
Nemipterus mesoprion	17.2	19.05	3.67	0.70	2346	9373	15527
Nemipterus japonicus	18.8	20.66	2.84	0.61	3446	6863	6941
Lactarius lactarius	13.2	17.77	3.73	0.66	376	635	1329
Cynoglossus macrostomus	11.5	10.69	2.94	0.61	4068	13122	10100

- Among shrimps, *M. monoceros* was found to be exploited optimally, whereas the other three species, *M. dobsoni*. *P. stylifera* and *S. choprai* were found to be underexploited during 2006. Of the two species of crabs, *P. pelagicus* was found under exploited while, that of *P. sanguinolentus* was slightly overfished.

Stock parameters of dominant shrimp and crab species in Karnataka-Goa (2006)

Species	Size at maturity (cm)	Optimum length at capture	Fishing mortality rate	Exploitation rate	Spawning stock biomass(t)	Standing stock biomass(t)	Yield(t)
Metapenaeus dobsoni	7.10	7.02	3.40	0.60	493	1184	2217
Parapenaeopsis stylifera	8.35	7.27	2.10	0.44	423	1100	1465
Metapenaeus monoceros	11.60	11.56	2.86	0.51	1726	3146	6515
Solenocera choprai	6.50	7.27	1.56	0.41	1016	1424	1029
Portunus pelagicus	9.60	10.44	1.75	0.44	465	722	817
Portunus sanguinolentus	8.96	10.50	4.28	0.60	141	208	622

Molluscan resources

- Squid and octopus landings which were declining since 2004, improved in 2006; cuttlefish landings also showed an increasing trend. Dominant species: the squid *L. duvauceli*; the cuttlefishes, *S.*

pharaonis and *S. elliptica*, and the octopus, *O. membranaceous*. Fishable potential of cephalopods from Karnataka-Goa waters is estimated at 16,494 t. *L. duvauceli* was found to be exploited around an optimum level, whereas *S. pharaonis* and *S. elliptica* were found underexploited.

Stock parameters of dominant cephalopod species in Karnataka-Goa (2006)

Species	Mean size (cm)	Size at maturity (cm)	Fishing mortality rate	Exploitation rate	Spawning stock biomass(t)	Standing stock biomass(t)	Yield(t)
Loligo duvauceli	12.7	11	2.2	0.55	2701	3466	7804
Sepia pharaonis	17.9	12.9	1.43	0.43	5141	5545	6731
Sepia elliptica	9.8	9.6	1.0	0.36	1108	1555	612

- The clam production from the estuaries of Karnataka was estimated at 11,971 t, showing a decrease of 11% as compared to last year. The exploitation rate of the dominant species *Meretrix casta* and *Paphia malabarica* was 0.7 in Mulky estuary. In Coondapur estuary, it was 0.6 and 0.5, respectively for these species.
- Mussel production in Karnataka was estimated at 8,842 t, showing a decrease of 8% from that of the previous year. The exploitation rate was 0.4. The mean size was 84 mm as against the L_{opt} of 73 mm and the species was green mussel, *Perna viridis*. This indicates that effort can be increased for harvesting more mussels.
- The gastropod *Babylonia spirata* production was estimated at 115 t (Malpe), showing a decrease of 36% from that of the previous year. The exploitation rate was 0.7. The mean size (34 mm) was less than the optimum size of 39 mm.

Mesh selectivity experiments

- Trawl net selectivity experiments using covered cod-end technique was conducted with cod-end mesh sizes (diamond and square) 20-100 mm. Mesh selectivity data for 21 species were collected and for 6 species the selectivity was standardized. Results show that the length at first capture of these species is much below the size at first maturity. Trawl cod end mesh size of 35 mm holds good for *M. dobsoni*, but for other species the mesh size should be higher according to study.

Species	Length at first capture (mm)	Length at first maturity (mm)	Selection factor	Mesh type	Recommended mesh size (mm)
Metapenaeus dobsoni	51	75	2.49	Diamond	30
Metapeanaeus dobsoni	51	75	2.94	Square	26
Parapenaeopsis stylifera	58	80	2.13	Square	38
Dussumieria acuta	114	142	3.88	Diamond	37
Dussumieria acuta	114	142	4.07	Square	35
Lactarius Lactarius	125	178	2.77	Diamond	61
Nemipterus japonicus	128	188	3.4	Square	55
Saurida tumbil	205	264	4.2	Diamond	63
Saurida tumbil	205	264	4.2	Square	60

Socio-economics and behavioural dimensions of stakeholders

- Analysis of data collected on the socio-economics and behavioural dimensions of 300 stakeholders each, from the two selected districts of Karnataka namely Dakshina Kannada and Udupi, indicated that under the Primary sector, purseseine operating owners had the highest monthly income of Rs. 3.63 lakhs. The average investment in the present avocation was Rs. 40.66 lakhs and the average turn over/day was Rs. 20,000 and the average daily income of the respondents was Rs. 15,000. The average volume of fish catch handled per day was 5 t and the average duration of work/day was 12 hours. The mesh size of purse-seine nets used was 12-24 mm.
- The multi-day trawler operating owners came next in the order with an average monthly income of Rs. 60,000. The average investment in this avocation was Rs. 33 lakhs and the average turn over/day was Rs. 8,266. The average volume of fish handled per day was 13.5 t and the average duration of work/day was 12 hours. The mesh size of trawl nets used was 8-17mm.
- High fuel cost, followed by depletion in resources and low first sale prices of fishes were the most important occupational constraints faced by the primary sector stakeholders.
- Under the secondary sector, the wholesalers had the highest average monthly income of Rs. 21,096. The average investment in the present avocation was Rs. 3.90 lakhs. The average daily income of the respondents was Rs. 706. The average volume of goods handled per day was 13,177 kg of fish and duration of work/day was 9 hours.
- Among the secondary sector, fish sorters at Malpe Fisheries Harbour had the lowest average monthly income of Rs 2,157. Their average turnover/day was Rs. 100. The average daily take-home income of the respondents was Rs. 83. The average volume of goods handled per day was 700 kg of fish. The average duration of work/day was 11 hours.
- Among the tertiary sector stakeholders, owners of petty shops and hotels at Mangalore Fisheries Harbour had the highest average monthly income of Rs. 9,513. The average investment in the avocation was Rs. 77,236. The average turn over/day was Rs. 11,631. The average daily take home income of the respondents was Rs. 317.

PROJECT CODE	**PEL/IDP/03**
PROJECT TITLE	**Appraisal of marine fisheries of Lakshadweep**
SCIENTISTS	**K. P. Said Koya,** T. V. Sathianandan and C. Ramachandran
CENTRES	Minicoy, Chennai, Cochin

- The total fish landings using Pole & Line ,Troll Line, Encircling Gill net, Drift Gill net & Hand Lines in Lakshadweep was estimated at 7500 t which was about 31.8 % lesser compared to 2005.
- 18 of the 28 FADs deployed in January-February 2006 were dislocated and lost. *Elegatis* sp., *Coryphaena* sp., *Chorinemus* sp., and other carangids were the important groups aggregated around these near-shore FADs. However, the NIOT data-buoys launched at

16 and 24 nautical miles off Minicoy acting as FADs yielded 995 t (64 %) of the total tuna catch in Minicoy.

- Pole & Line accounted for 93% of the total catch and was found to be the most efficient gear with the catch rate of 4.82 Kg /head/hour followed by hand lines with 3.42 Kg/head/hour. The drift gill net was the least productive with only 1.23 Kg /head /hour.
- Flying fishes & Belones are the potential resources exploitable using encircling gill net with scaring lines.
- Highly migratory, mid-water larger yellow fin tunas are available in fairly good concentrations in Lakshadweep waters from September – March and can be exploited, particularly at dawn and dusk operations, using long lines, deep hand lines and drift-nets .

Gears and period of operation of fishing gears

Fishes	Gears	Period
Skipjack	Pole & Line and Troll Line	November to April
Yellowfin	Deep hand line, Long line,	
	Troll line &Drift Gill net	September to March
Wahoo	Troll line	September to November
Sailfish	Troll line	September to November
Belones	Encircling Gill net	August to October
Flying fishes	Encircling Gill net	December to March
Larger carangids	Hand line	June to August &
	Troll line	November -December

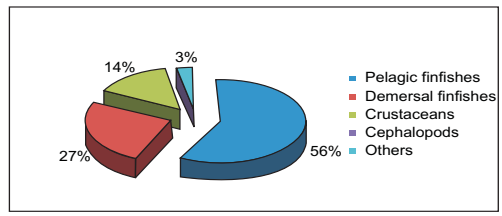
Growth and mortality parameters of *Katsuwonus pelamis*

Method	L_α	K	t_0	Score
ELEFAN	65.54	0.997	-0.380	0.356
SLCA	85.00	0.691	-0.397	1994.66
Projection matrix	84.99	0.803	- 0.225	-0.8143

- The total mortality (Z) was estimated as 1.78 using growth parameters L_α =85 cm, K=0.93 and t_0=-0.397.
- A single species of sprat was the live bait captured for pole & line fishing at Northern Islands where as sprats, caesionids and apogonids were used as livebaits at Minicoy. However, *Herklotsichthys quadrimaculatus* used in 2005 by Minicoyans was not used in 2006.
- The Catch per Unit Bait (CPUB) in Pole & Line was declined by 21.2 % .The fishermen attributed the decline to the presence of large quantities of forage organisms like shrimps, squids and crabs in the fishing grounds.
- Fishing formed the main source of income to only 5% of islanders while seamanship was the source to about 85 % of the Minicoyans.
- Very good earning was made from fishing and '*Mas*' sales. The market closed at Rs.220/kg at the end of the year against Rs. 130/kg in 2005.The rates for the fresh fishes sold to the entrepreneurs for marketing in mainland also shot up to Rs.20-30 per kg against Rs.18-20 per kg in 2005.

PROJECT CODE	**DEM/IDP/01**
PROJECT TITLE	**Appraisal of marine fisheries of Gujarat**
SCIENTISTS	**G. Mohanraj,** K.V. Somasekharan Nair, P.K. Asokan, S. Ghosh, V.P. Vipin Kumar and K. Madhu (CIFT)
CENTRES	Veraval and Cochin

- The total marine fish production of Gujarat for 2006 was estimated at 5.08 lakh tonnes, the fishery showing an increase of 42.7% compared to 2005. The pelagic landings were estimated to be 1.93 lakh tonnes forming 38% of the total production. The demersal resources contributed 25.8% (1.31 lakh tonnes), followed by crustaceans 24.3% (1.24 lakh tonnes) and molluscs 10% (0.5 lakh tonnes).
- Catch rate in 2006 increased for all the gears for all the resources as compared to 2005.
- Multiday trawling contributed 50% to the total marine fish landings. Singleday trawl catch decreased by 21.5% and multiday trawl landings increased by 68% over 2005.
- Multiday trawl operations were aimed at exploitation of valuable target species with specific gears and in specific fishing grounds.
- Ribbonfishes recorded twofold increase in catch and contributed 17.7% to the total marine fish landings.
- Nonpenaeid shrimps exhibited 75% increase in catch and contributed 17% to the total marine fish landings.
- Threadfinbreams (95%) and molluscs (80%) were the other resources showing significant improvement in catch.



Percentage contribution of different gears to the marine fishery of Gujarat during 2006

Stock estimates of dominant pelagic resources landed at Veraval

Species	Annual yield (t)	MSY (t)	E	E_{max}	Total Stock (t)	Standing Stock (t)
Trichiurus lepturus	39486	24678	0.8	0.44	89740	61696
Harpadon nehereus	30247	17924	0.84	0.43	14822	5318
Scomberomorus guttatus	366	207	0.88	0.55	417	70
Euthynnus affinis	178	98.6	0.91	0.59	202.4	58
Auxis thazard	165	95.3	0.87	0.62	193.4	46.7
Thunnus tonggol	585	350	0.84	0.57	734.2	235

Growth parameters and stock estimates of major demersal resources landed at Veraval

Species	L∞ (cm)	K/yr	M/yr	Lc (cm)	Annual yield (t)	Standing stock biomass (t)	Spawning stock biomass (t)
Nemipterus mesoprion	29.7	0.65	1.42	12	11463	13243	10615
Nemipterus japonicus	32	0.6	1.34	14.5	6207	10582	8861
Saurida tumbil	52.8	0.92	1.82	29	1879	1312	595
Saurida undosquamis	39.5	0.31	0.92	23	-	-	-
Pampus argenteus	38.4	0.24	0.82	18	-	-	-
Priacanthus hamrur	36	0.74	1.5	21	4146	1907	251
Johnius glaucus	28.2	0.27	0.86	14	-	-	-
Protonibea diacanthus	122	0.32	0.93	85	-	-	-
Otolithes cuvieri	39.5	0.53	1.25	16	6424	3478	2039

Landings of catfish (*Arius dussumieri*) by trawlers at Veraval

Landing of nonpenaeid shrimp (*Exhippolysmata ensirostris*) by 'dol' netters at Nawabunder

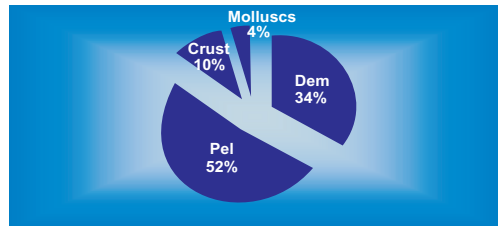
- Ribbonfish, Bombayduck, tuna, seerfish, lizardfish, croakers and Bull'seye were exploited above optimum level and threadfinbreams at optimum level.
- Population parameters of the squid *L. duvauceli*: L_{α} (cm) – 36.5, k – 1.2, M – 2.6 and annual yield (t) – 13935.
- Trawl gear selectivity study carried out with 34 m HOBT and 40 mm codend mesh size (diamond) has revealed that the selection factor for *T. lepturus* was 11.46.
- Socio-economic appraisal revealed a conservation orientation index of 92% in primary sector, 89% in secondary sector and 91% in tertiary sector for stakeholders.

PROJECT CODE	**DEM/IDP/02**
PROJECT TITLE	**Appraisal of marine fisheries of Tamilnadu and Pondicherry**
SCIENTISTS	**P.U. Zacharia,** H. Mohamad Kasim, G. Mohanraj, S. Lakshmi Pillai, Shoba J. Kizhakudan, T.V. Sathianandan, Wilson T. Mathew, A. Raju, M. Rajamani, V. Venkatesan, E.M. Abdussamad, T.S. Velayudhan, I. Jagadis and M.P. Ramesan (CIFT)
CENTRES	Chennai, Mandapam Camp and Tuticorin

- The marine fish landings along Tamilnadu and Pondicherry coast during 2006 was 3,59,276 t and 12, 478 t, respectively, which as compared to 2005, showed 20.0% increase in Tamilnadu and 15.3% increase in Pondicherry. The fishery, which was recovered from the December 2004 tsunami became stable.
- Pelagic fishes (52% of total landings) were dominated by sardines and mackerel. Demersal fishes, crustaceans and molluscs contributed 34%, 10% and 4% to the landings, respectively. Among the fishes, sardines formed the major catch (22.6%) followed by silverbellies (11.7%).
- Trawls (36.1%) and gillnets (26.4%) were the predominant gears
- Ramanathapuram and Tuticorin districts together accounted for 40% of the Tamilnadu marine fish landings.
- Population parameters estimated for ten pelagic stocks off Tuticorin indicated that the exploitation rate (E) ranged from 0.45 (*Sardinella sirm*) to 0.78 (*A. thazard*). The E was above 0.7 for the seerfish and tunas, indicating heavy exploitation of these stocks.
- Virtual Population Analysis was carried out for 13 demersal fish stocks of Chennai.
- Comparison of stock biomass and yield suggests that the yield has exceeded the biomass in the case of the sciaenids (*Johnius carutta* and *Nibea maculata*), the goatfish (*Upeneus taeniopterus* and *U. sulphureus*) and the silverbellies (*Leiognathus bindus* and *Gazza minuta*). The spawning stock biomass of *U. sulphureus* and *G. minuta* was very low (< 15% of standing stock biomass).

Population parameters of major pelagic resources exploited off Tuticorin

Species	Z	M	F	E	MSY(t)
Sardinella gibbosa	7.97	3.06	4.91	0.62	**7613**
S. longiceps	7.65	2.64	5.01	0.65	**1948**
S. sirm	5.83	3.23	2.60	0.45	**5669**
S. albella	5.25	2.19	3.06	0.58	**4801**
Rastrelliger kanagurta	6.90	2.52	4.38	0.63	**1520**
Scomberomorus commerson	4.76	1.34	3.42	0.72	**1493**
Euthynnus affinis	3.36	0.92	2.44	0.73	**1089**
Auxis thazard	5.89	1.32	4.57	0.78	**200**
Caranx ignobilis	3.18	1.3	1.88	0.59	**527**
Selaroides leptolepis	6.98	3.01	3.97	0.57	394



Contribution of fishery resource groups to the total landings of Tamilnadu

Growth, mortality parameters and stock estimates of major demersal finfishes exploited off Chennai

Species	L_α (cm)	K	M	Y (t)	Biomass (t)	SSB (t)	MSY(t)
Rastrelliger kanagurta	26	1.3	2.379	289			
Euthynnus affinis	72	1.2	2.322	100			
Dasyatis jenkinsii	148	0.3	0.904	120	210.1	64.1	
D. imbricatus	26.7	0.72	1.524	27.2	63.7	35.6	
Otolithes ruber	43.0	0.31	0.919	212.5	1048.8	888.2	394
Johnius carutta	29.2	0.76	1.583	84	47.2	22	85
Nibea maculata	29.0	0.82	1.671	90.8	47.5	20.8	91.8
Nemipterus japonicus	27.1	0.81	1.656	507.9	542.7	377	616.1
N. mesoprion	23.2	0.86	1.730	236.7	196.3	114.2	256.5
N. bleekeri	26.7	0.45	1.125	73.4	208.7	141.2	119.2
Upeneus taeniopterus	26.0	0.66	1.435	284.4	127.4	26.3	284.9
U. sulphureus	21.5	0.76	1.583	170.1	100.3	15.1	174.5
Saurida undosquamis	39.5	0.31	0.92	498.6	1129.4	254.4	573.3
Leiognathus splendens	16.1	1.1	2.08	391.2	319.7	141.6	490
Gazza minuta	16.3	1.3	2.38	358.8	227.8	14.2	405.6

- The exploitation rate of the shrimp *M. dobsoni* and the sand lobster *Thenus orientalis* off Chennai was very high at 0.8 and 0.75, respectively. Spawning stock biomass of *M. dobsoni* was estimated as 39 t, standing stock biomass as 60 t and total yield as 211 t. MSY was estimated as 231 t.
- Off Mandapam too, the exploitation rate of *Penaeus semisulcatus and P. pelagicus* was very high at 0.73 and 0.86, respectively.
- Time series data on marine fish landings along Tamilnadu during 1989-2005 was used along with effort (hours) expended to develop Schaefer's Surplus Production Model. The Maximum Sustainable Yield was estimated as 3,52,023 t, biomass at MSY level as 5,32,947 t, and effort at MSY level was 17 million hours. In 2005, the total catch was below the MSY, but during 1999-2004, the catch was above the MSY.

Mortality and stock estimates of crustaceans exploited from Mandapam and Chennai

	Z	M	E	Biomass (t)	SSB(t)	Y (t)
Mandapam						
Penaeus semisulcatus	5.36	1.11	0.73	423.1	456.4	740.7
Portunus pelagicus	8.88	1.26	0.86	412.2	168.5	835.5
Chennai						
Thenus orientalis	3.62	0.89	0.75	2650.8	1037.3	3436

PROJECT CODE **DEM/IDP/03**

PROJECT TITLE **Appraisal of marine fisheries of Orissa**

SCIENTISTS **S. Sivakami,** G. Maheswarudu, Sheela Immanuel, Somy Kuriakose and G. Rajeswari (CIFT)

CENTRES Cochin and Visakhapatnam

- A total of 19 different types of gears were operated along the Orissa coast which were grouped as mechanized (MDTN, MTN, MDN, MGN, MDGN, MHL), motorized (OBGN, OBDN, OBBGN, OBHL, OBRN, OBRS) & non-motorized (NMGN, NMHL, NMSS, NMBS, NMDN, NMBGN, NMRN).
- The total fishing effort was 5,48,692 units expended by mechanized (10.18%), motorized (53.68%) and non-motorized (36.14%) gears.
- In terms of hours, a total of 31,02,427 hours were expended by mechanized (45%), motorized (33.3%) and non-motorized gears (21.6%).
- The total landing was 89586 t contributed by pelagic fishes (41,062 t, 46%), demersal fishes (34,036t; 38%) and crustaceans and molluscs (13608t, 15.2%).

Resource-wise landings (t) at Orissa during 2006

Resource	Mechanised gear (t)	Motorised gear(t)	Non-motorised gear (t)	Total catch(t)
Pelagic fishes	24844	12137	4081	41062
Demersal fishes	24507	8374	1155	34036
Crustaceans & Molluscs	12418	926	264	13608
Miscellaneous	579	149	152	880
Total	62348	21586	5652	89586

- Compared to 2005, the catch during 2006 was declined by 11914 t (11.7%).
- Mechanised gears landed 60.4% of total pelagics, 72% of total demersals and 91.3% of total crustaceans.
- The peak period of fishery was October-February and June-July with lean months of fishing in May. During 2005, peak landing was noticed during November-January and lean period during April-June.
- Among pelagic fishes, ribbonfishes (9531 t; 23.2%), clupeids (16378

t;39.9%), carangids (7572 t;19.4%) and Indian mackerel (3268 t; 8%) were the major groups landed. Among demersals, (34036 t) the major contribution was by sciaenids (12952 t, 38%), followed by catfishes (5908 t; 17.4%), silverbellies (1947 t; 5.7%) and pomfrets (3,959 t; 11.6%). Crustaceans such as penaeid shrimps (10523 t; 80%), non-penaeid shrimps (1,368t, 10.4%), crabs (1106 t; 8.4%) and stomatopods (94 t; 0.7%) were the major groups.

PROJECT CODE	**CF/IDP/01**
PROJECT TITLE	**Impact of selective fishing of juveniles and brood fish capture, FADs and searanching on stock health**
SCIENTISTS	**E.V. Radhakrishnan,** A.P. Dineshbabu, K.K.Philipose, Mary K. Manisseri, J. Jayasankar, M. Rajamani, K.R.Manmadhan Nair, H. Mohamad Kasim, G. Mohanraj, Shoba J. Kizhakudan, S. Lakshmi Pillai, K.P. Said Koya, G. Maheswarudu, I. Jagadis and M. Zaffar Khan
CENTRES	Cochin, Mangalore, Calicut, Mandapam Camp, Chennai, Minicoy, Visakhapatnam, Tuticorin and Mumbai

During this year juvenile composition of the trawl catch and selective fishing by 'dol nets', 'minitrawls' and 'thalluvalai' were monitored. Fish catch from FADs and artificial reefs was also estimated.

Selective fishing and juvenile composition

- Minitrawls at Pallithode -Chellanam region landed 232 t of fishes and shellfishes with a CPUE of 39.3 kg. Shrimps accounted for 81% (188 t) and total catch was 14% lesser than the previous year.
- The major landings (61%) were during March, April and May. *M. dobsoni* (36.5%) and *P. stylifera* (63%) are the two major shrimps species.
- Size of *M. dobsoni* varied from 41-100 mm TL. Annual mean size of females was 71.5 mm TL**.** Size range of *P. stylifera* was 41-115 mm TL; annual mean size of females was 70.0 mm TL.
- Annual mean size of females of *M. dobsoni* in trawl fishery was 87.1 mm TL and *P. stylifera*, 91.7 mm showing smaller size of shrimps caught by minitrawls.
- 32.8% of females of *M. dobsoni* and 53.2% of females of *P. stylifera* caught were below the first sexual maturity.
- If minimum size at sexual maturity (MSM) is considered to define 'juvenile', the size of juveniles of *P. stylifera* (MSM) is to be fixed at 45 mm TL. The difference in price of juvenile and larger shrimps was around Rs.50/- kg and total economic loss due to capture of juveniles by minitrawls was Rs.47 lakhs.
- Total landing of edible crabs in 2006 was 9 t with a catch rate of 1.5 kg per unit as against 23 t with a catch rate of 6.3 kg per unit during the previous year, showing drastic decline both in the catch and catch rate. Peak landing was recorded during March-April.
- *P. sanguinolentus* (71%) dominated the fishery followed by *C. lucifera* (25%). The landings of *P. pelagicus* decreased from 22% during the

previous year to 4% while *C. lucifera* showed an increase from 3% to 25%.

- The mean size of *P. sanguinolentus* decreased from 95.3 mm and 93.1 mm in the previous year to 79.5 mm and 78.2 mm in males and females, respectively. The modal classes also decreased from 81-110 mm in 2005 to 71-80 mm in 2006. 75% of female crabs were in immature stage. In case of *C. lucifera*, smaller size groups which could not be used for human consumption formed a major portion of the landing. Exploitation of juveniles at this rate by mini-trawls is detrimental to *C. lucifera* which is actually an emerging fishery in this region.
- Crabs as small as 16-20 mm CW were landed, the modal class being 41-65 mm and 88% of males and 98% of females being less than 65 mm in CW.
- The estimated catch and catch rate of shrimps from 'thalluvalai' are 4.7 t (1.3 kg/hr) and 30.4 t (0.6 kg/hr) at Thoppukkadu and Thiruppalaikudi, respectively and fishery was mostly constituted by *P. semisulcatus*.

Landing of junveniles of groupers

- Size of *P. semisulcatus* range from 70-178 mm in females with dominant mode at 96-100 mm TL at Thoppukkadu. At Thiruppalaikudi, size ranges from 53-193 mm TL in females and modal length is 111-115 mm TL.
- Immature females constituted an average 68% and 89.9% at Thoppukkadu and Thiruppalaikudi, respectively.
- Creation of awareness on adverse impact of destruction of juvenile shrimps among fishermen and establishment of artificial reefs in the nursery areas and promotion of gears like hooks and line for fishing are management measures suggested.
- The 'Dol net' landings were monitored at two centres at Mumbai; at Arnala 625.5t of *H. nehereus* with a catch rate of 95 kg/unit was landed, forming 36.5 % of total catch. Other constituents were *Coilia dussumieri* (17%) and *Nematopalaemon tenuipes* (12%). Juveniles constituted 87.5% of *Harpado nehereus* and 89% of *C. dussumieri* catch.
- At Sassoon docks, 403.3 t of *H. nehereus* with a catch rate of 75/kg/unit was landed forming 32% of total catch.
- Juveniles of *H. nehereus* formed 95% of total catch and 94% of *C. dussumieri* landed were also juveniles.
- 'Dol nets' operating in the inshore sea harvest mostly juvenile fishes and shellfishes and will have negative impact on these two major fisheries.

Juvenile composition of trawl fishery

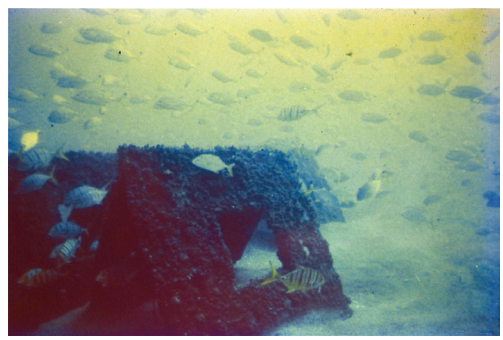
- The Minimum Size at Maturity (MSM) was considered as the cut off point to differentiate juvenile from adult, instead of size at first maturity (50%). During 2006, juvenile landings by trawlers were estimated using the MSM criteria at Mangalore.

- The entire catch of 188 t of *S. commerson* landed by trawlers at Mangalore was juveniles. 30.5% of *Lactarius lactarius* and 26% of *C. macrostomus* landed were also juveniles. In *E. diacanthus*, which exhibits 'protogyny', 95% of catch (3464 t) was constituted by immature females.
- In Purse-seine, 58% of catch of *S. longiceps* (2665 t) and 63% of *Megalaspis cordyla* were juveniles. The economic loss will be tremendous as the price difference between juveniles (smaller fishes) and table- size fishes is large.

Trawl landing of juveniles of seerfishes at Mangalore

Fishery of FADs and artificial reefs

- During 2006, 16.8 t of demersal fishes were caught by 1107 hooks and line units at Chinnandikuppam near Chennai. Perches formed 51% of total catch. 'Nanduvalai' (gill net) landed 41.5 t of fishes. 'Pannuvalai' landed 25.4 t of fishes. At Nainarkuppam 11.9 t of fishes were landed by hooks and lines. 32% of the catch was by perches (4.3 kg/unit). *Lethrinus nebulosus* formed 48% of the catch at Chinnaneelankarai. 18 t of fishes were landed by hooks and lines. Perches formed 41.3% of total catch. *L. nebulosus* formed 51%. FADs support good demersal fishery and fishermen were benefited by the high value fish catch from FADs.
- Major pelagic fishes caught from Chinnandikuppam, Nainarkuppam and Chinnaneelankarai were seerfish and carangids. 0.7 t of carangids by hooks and lines was landed at Chinnandikuppam (September-December). At Nainarkuppam 1.8 t (9.5 kg/unit) of carangids and 585 kg of seerfishes were landed.
- At Minicoy, data buoys of NIOT continued to support good fishery. 65% (995 t) of total catch landed at Minicoy was fished around the buoys.
- During 2006, fish landing at Minicoy was only 42% of catch of the previous year (2374 t). However, fishermen got higher price for 'Mas' (Rs.175/kg) compared to Rs.120/kg in the previous year. *K. pelamis* (95%) constituted the FAD fishery.
- At Thikkody reef installed during 2001-03, drift gill nets landed 63.9 t of carangids, 13.7 t of barracudas, 64.1 t of *Stolephorus* sp. and 10.6 t of silverbellies. Bottom-set gillnets landed 4.3 t of lobsters.
- From Dharmadom reef 228 t of fishes with a CPUE of 36.6 kg/unit were landed. Carangids, barracudas, *Thryssa* sp., silverbellies and *Stolephorus* sp. were the major groups. From Muttom reef installed during 2002-04, drift gill nets landed 182.6 t of fishes. Carangids, barracudas and silverbellies were the main constituents.



Aggregation of fishes around an artificial reef

Searanching

- Seed production of *P. fucata* was initiated. 1,00,000 spats (2-3 mm size) have been raised and reared to 10 mm which is suitable for ranching.
- The sites suitable for pearl oyster ranching were surveyed. The three sites were Vadaimedu, a site off Punnakayal and Vaipathampar and faunal composition was similar in all three sites.
- 7.1 million postlarvae of hatchery produced seeds of *P. semisulcatus* were released in Gulf of Mannar.

Exploitation and trade of brooder shrimps

- *P. monodon* formed 5.6% of total shrimp catch at Chennai (1962 t). Length of *P. monodon* ranged from 161-303 mm and 82.8% were gravid. The modal length was 226-230 mm TL and mean size 214 mm TL. The price of gravid females fluctuated between Rs. 1000-3000 per specimen and 'empties' Rs.100-150/- per piece.
- The total estimated brooder shrimp *P. monodon*, traded at Visakhapatnam Fishing Harbour during the reporting period were 6,513. Length range was from 198 mm TL to 303 mm TL with mean size at 258.39 mm TL and mode at 273 mm TL.
- More than half of the brooders that were traded during the reporting period were 'gravids' (51.3%) followed by 'stages' (35.2%) and 'empties' (13.5%). Gravids fetch high price ranging from Rs.2000/- to 9,550/- per brooder compared to that of 'stages' and 'empties'.

Statistical analysis

- The data sufficiency of the monthly trawl data collected from Mangalore Centre vis-à-vis estimation of parameters like SSB has been studied.
- A model involving SSB and number of new recruits on the lines of 'Yield' software model has been proposed, needing a three year gestation for validation.

PROJECT CODE	**CF/IDP/02**
PROJECT TITLE	**Studies on discards and low-value bycatch of trawlers**
SCIENTISTS	**G. Nandakumar,** K.V. Somasekharan Nair, Miriam Paul Sreeram, Paramitha Banerjee, S.Sivakami, T.S. Velayudhan, J. Jayasankar, Rekha Devi Chakraborty, P.V. Sreenivasan, S. Lakshmi Pillai, G.Mohan Raj, Shoba J. Kizhakudan and G.Maheswarudu
CENTRES	Veraval, Mumbai, Cochin, Chennai and Visakhapatanam

Veraval

- During the year, monitoring of landed low-value bycatch and discards by trawlers at five centres was carried out**.** The periodicity of sampling efforts and the estimated proportions were studied against the backdrop of the sampling schedule followed by FRAD. A two-phase sampling estimator has been finalized with the estimation of hauls of MTN off Neendakara as the first phase and estimation of proportion as a subsampling exercise.
- An estimated 39,139 t of low-value bycatch with a catch rate of 27.44 kg/hr was landed at Veraval. Maximum landing was during October-November. Crustaceans (49.9%) and fishes (49.7%) were the major contributors. Trawl nets with cod-end mesh size of 12 mm were used for fishing.
- About 1/3 of the catch was contributed by *Acetes* spp. (33%); 10.6% was contributed by juveniles of *Trichiurus* spp.. The estimated value of low-value bycatch landed by fishing trawlers at Veraval during January-December was Rs.7.8 crores @ Rs.2/kg.

Mumbai

- Estimated bycatch landed by trawlers at Mumbai was 16887 t with a catch rate of 2.3 kg/hr. Percentage of bycatch in total catch was

8.7%. 77% was constituted by fishes and 10.6% of bycatch was body parts of shrimps and fishes.

- Percent of bycatch in total catch was maximum in October (22%) and minimum in March (4%). Bycatch was constituted by 75 species of marine organisms. Juveniles of *S. longiceps* (18.5%), *C. dussumieri* (11%) and *C. callianassa* (11%) were the main constituents.

Sakthikulangara-Neendakara

- 1674 tons of bycatch were landed at Sakthikulangara with a catch rate of 14.1 kg/hr.
- Multiday fishing units discard the low-value bycatch in the sea and single day trawlers bring it to shore. Percentage of bycatch in total catch ranged from 7-23%.
- The bycatch consisted of fishes (46.4%), crustaceans (37.6%) and molluscans (16%). Highest landing was in November (22%).
- An estimated 1228 t of bycatch was landed at Neendakara with a catch rate of 10.03 kg/hr. Maximum landing was during September (324 t) followed by March (223 t).

Chennai

- 1616 t of bycatch was landed at Kasimedu, Chennai with a catch rate of 3.2 kg/hr which formed 10.2% of the total catch.
- Maximum bycatch was during July and September forming 15.4% and 12.4% of total catch, respectively. Fishes contributed 57.1% of total bycatch. Juveniles of fishes ranged from 33.5-76%.
- Crustaceans form 34% of total bycatch. Crabs were dominant (52%) followed by stomatopods (22%) and shrimps (18%).
- The bycatch formed 8% of total catch during June and 75% during December (average, 39.7%) and was represented by 66 species/groups of fishes in addition to crustaceans and cephalopods. Among crustaceans, juveniles of shrimps formed 5.8%. The most frequently encountered juveniles were *S. longiceps*, *T. lepturus* and *C. macrostomus*. There was no discards as the entire catch was brought onshore.

Trawler with a load of low-value by catch at Mangalore Fisheries Harbour

Visakhapatnam

- Total estimated low-value bycatch and discards at Visakhapatnam were 24,668 t and accounting for 55.4% of the total landings of the trawlers. Discard rate was higher during June, July, September and November.
- Bycatch was constituted by finfishes (73.1%), crustaceans (25.4%) and molluscs (2.5%). Of the 45 genera/species of finfishes represented in the low-value bycatch, *Nemipterus* spp. (10.9%) dominated followed by-eels, *Apogon* spp and *Leiognathus* spp.
- Of the 14 genera/species of crustaceans represented in the catch, crab *Charybdis hoplites* (7.4%) dominated followed by *Oratosquilla interrupta* (7.09%), *Cloridopsis immaculate* (3.15%) and *Charybdis truncata* (3.74%). Among molluscans, *Sepia* spp. (0.84%) dominated followed by *Octopus* sp. and *Sepiella* spp.
- The landed bycatch (630 t) was sold at Rs.10/basket (5 kg) and the estimated value was Rs.12.6 lakhs.

PROJECT CODE	**CF/IDP/03**
PROJECT TITLE	**Appraisal of marine fisheries of Maharashtra**
SCIENTISTS	**V. D. Deshmukh,** Alexander Kurian, M. Zafar Khan, Miriam Paul Sreeram, Paramita Banerjee Sawant, Somy Kuriakose and V.P. Vipinkumar
CENTRES	Mumbai and Cochin

- In Maharashtra, the estimated marine fish landings during 2006 were 3.34 lakh t, which recorded 20.4% increase as compared to 2.82 lakh t in 2005.
- Shrimp trawl was the major gear that contributed 58.3% to the total marine landings of the state followed by '*dol*' nets (26.2%), gill nets (9.1%), purse seines (3.3%) and others 3.1%.
- During the year, gear-wise fishing effort and the catch showed increase, but the catch rates of trawlers and purse-seiners declined by 6.3% and 27.7%, respectively. This resulted in layoff of particularly the purse-seiners during February-May and November-December. Compared to 2005, the catch in *dol* nets increased by 29% and the catch rate by 22.9%; in gill nets the catch rate improved by 20.7%.
- Biological and population data for the resources were collected from New Ferry Wharf (NFW), Sassoon docks, Versova, Arnala, Satpati and Vasai landing centres.

Landing of egg bearing spiny lobster *Panulirus polyphagus*

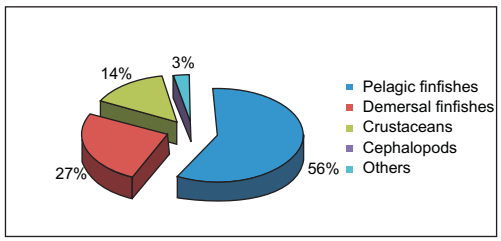
- The resources, which showed significant increase over the last year's catch, were ribbonfishes (+126%), eels (+77%), lobsters (+63%), elasmobranchs (+30.5%), non-penaeid shrimps (+22%), mackerel (+32%), bombayduck (+12.1%) and cephalopods (11.6%) while threadfin bream (-14.3%) and penaeid shrimp (-7.2%) showed decline.
- Bombayduck was landed more by the trawlers (47.2%) than *dol* nets (45.9%); the catch rate was highest in October and December in the former and in September in the latter. The maximum number of mature females were noticed in July (70%) and December (35%) but none were having gravid and ripe ovaries. The food mainly consisted of *C. dussumieri*, *N. tenuipes* and *Acetes* spp.
- Ribbonfish catch doubled to 31,480 t and the highest catch rate at NFW was recorded in December (6.3 kg/hr). *T. lepturus* supported the trawl fishery. The mature females were noticed in February and April (40%). Annual mean size of the fish was 55.2 cm while optimum size of capture was 57.2 cm. With total and fishing mortality of 3.68 and 2.22, the exploitation ratio of the species was 0.60.
- The catch of golden anchovy *C. dussumieri* declined in trawl at NFW and *dol* nets at Arnala. The annual mean size was 15.6 cm in trawler and 11.9 cm in the *dol* nets; the catch consisted of juveniles, 73% at the former and 89% at the latter. The food consisted of *Acetes* spp, copepods and amphipods. The relative YPR gave exploitation ratio, which was 0.54 while E_{max} at 0.1 was 0.56 indicating over-exploitation.
- Almost entire fishery of *Pampus argenteus* was constituted by juveniles (<270 mm). The juveniles were caught maximum in trawl (97%), followed by *dol* nets and gill nets and therefore urgent steps

to conserve this fishery from growth overfishing are necessary. The exploitation ratio during the period was 0.64 while E_{max} was 0.49, which also clearly indicated the species was grossly over-exploited.

- Relative abundance of sciaenids showed *J. vogleri* (27.6%), *J. macrorhynus* (24.8%) and *O. biauritus* (20.5%). Annual mean size of *O. biauritus* and *J. vogleri* was 425 mm and 194 mm and their juveniles in the catch accounted for 97.6% and 13.6%, respectively. Mortality parameters suggested overexploitation of both the species.
- Among the groupers *E. diacanthus* dominated the catch (73%) and juveniles constituted 70% and 51% by numbers and weight, respectively. It is a protogynous hermaphrodite and studies on its gonadal development have been initiated.
- *O. militaris* dominated catfish landings by trawlers but juveniles accounted for 71% of the total catch. With exploitation ratio of 0.63, the species is also considered as overfished.
- Among threadfins, *N. mesoprion* was the dominant species (53.2%) with annual mean size of 132.6 mm. The exploitation ratio during the year was 0.85, which suggest urgent steps for conservation of the resource.
- The mortality parameters of penaeid shrimps, which accounted for 79% of the catch in the State, indicated that *P. stylifera* and *M. monoceros* were marginally under-exploited while *S. crassicornis* was optimally exploited; *M. affinis* and *P. merguiensis* were over-exploited.
- Nearly ten-fold increase in landing of juvenile lobsters (<200 mm TL) by the artisanal fishery (using old gill nets spread over rocky sub-tidal waters) shows success of spawning stock in 2004. However, such largescale exploitation of juvenile lobsters is detrimental to the lobster fishery and needs to be strictly prevented.
- Squid *L. duvauceli* (51%) dominated trawl landings at NFW, followed by *S. aculeata* (17%), *S. pharaonis* (15%), *S. inermis* (11%) and *Octopus* spp (6%). The biomass of the four species was 16t, 500t, 1230t, 3980t and 2390 t, respectively.
- Analysis of time series of catch and effort data (1991-2006) for trawlers by Schaefer's surplus production model revealed optimum trawling fleet of 2100 units against the present fleet of 4219 units. Therefore, the suggestion is to reduce the fleet by 48%.

PROJECT CODE	**MF / CAP /01**
PROJECT TITLE	**Appraisal of marine fisheries of Andhra Pradesh**
SCIENTISTS	**G. Syda Rao,** M. Srinath, G. Maheswarudu, Prathiba Rohit, Sheela Immanuel, U. Raj Kumar (CMFRI), R. Reghu, Rajeswari (CIFT)
CENTRES	Visakhapatnam and Cochin

- The marine fish landing in Andhra Pradesh during 2006 was estimated at 2,16,863 t. As compared to the corresponding previous year, the catch increased by 36 %.
- The mechanized, motorized and the non-mechanised sectors contributed 46.1 %, 23.9 % and 29.9%, respectively. The catch recorded an increase in all the sectors, the increase being 49.3%, 52.7% and 13.7%, respectively.



Contribution of different fishery groups to the marine fishery of Andhra Pradesh

- The trawls were the major gear contributing 41.6% followed by gillnets (41.2%), seines (12.9%) and the hooks and line (4.3%).
- Pelagic finfishes, demersal finfishes, crustaceans, cepahalopods and other fishes formed 56.6%, 26.6%, 13.9%, 0.09% and 2.8%, respectively.

Pelagic resources

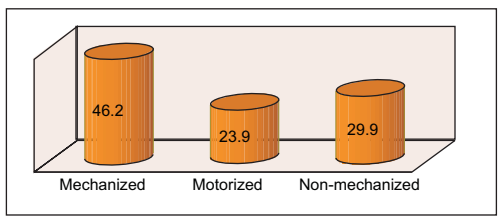
- The major exploited pelagic resources supporting the fishery in Andhra Pradesh were lesser sardines (11%), ribbonfish (7.5%), mackerel (5.9%) and *Stolephorus* (5.1 %). Among the major pelagic species the mean size of *S.guttatus* was higher than the length at first maturity. In the case of *S.gibbosa* and *R.kanagurta* the mean size was lower than the length at first maturity.
- Among the major pelagic species studied, *R.kanagurta*, *S.gibbosa* and *T.lepturus* were harvested much above the optimum levels where as *S.guttatus* was exploited at levels lower than optimum.

Demersal resources

- The major demersal resources that contributed to the fishery of the region and monitored for the biology were threadfin breams, lizardfishes, sciaenids, goatfishes and pomfrets. *N. japonicus, U. vittatus, J. carutta* and *O. ruber* were exploited at levels higher than optimum.

Crustacean resources

- The estimated penaeid shrimp catch along the Andhra coast was 22,378 t. Mechanized trawlers contributed maximum (74.4%) followed by non- motorized gill nets (12.9%), motorized gill nets (8.1%), non mechanized seines (2.9%), mechanized gill nets (0.9%) and motorized seines (0.6%). The cph was 5.7 kg for mechanized trawlers. The cpue was 5.9 kg and 3.6 kg for motorized gillnets and non-motorized gill nets, respectively.
- Small-mechanized trawlers catch at Visakhapatnam recorded 22 species of shrimps with *M. monoceros* (26.2%) being the dominant species followed by *S. melantho* (13.2%) and *M. dobsoni* (11.2%).
- Catch of Sona boats (multi-day trawlers) at Visakhapatnam was represented by 16 genera/ species. Catch was dominated by *M. monoceros* (30.8%), followed by *Solenocera* spp. (18.8%) and *Metapenaeopsis* spp. (8.9%). Exploitation level of *M.monoceros* and *M.dobsoni* were found to higher than optimum.
- The estimated catch of crab resources was 6,664 t. Mechanized trawls contributed maximum (52.5%) followed by non-motorized gill nets (25.4%), motorized gill nets (13.5%), mechanized gill nets (6.9%) and others (1.7%). The cph was 1.2 kg, 2.1 kg, 2.9 kg and 2.5 kg for mechanized trawlers, non-motorized gill nets, motorized gill nets and mechanized gill nets, respectively.
- Crab catch in small trawlers and Sona boats at Visakhapatnam Fishing Harbour was dominated by *Portunus sanguinolentus* (69.3 %), *P. pelagicus* (17.2%) and *C. feriatus* (13.5%).



Contribution (%) of different sectors to the marine fish landings of Andhra Pradesh

Molluscan resources

- Cephalopods were observed mainly in trawlers and this gear landed 95.5% of the total cephalopod landings of the state. The small trawlers contributed 35% and the large multiday trawlers contributed 65% of the cephalopod catch.
- Cephalopods were represented by squids (6%) and cuttlefish (94%). *L. duvauceli* was the dominant squid species.
- Cuttlefish was represented by *S. aculeata* (46.3%), *S. pharaonis* (34.7%) and *S. inermis* (14.1%).

Socioeconomics

- The social and behavioural patterns of fisherfolk at Visakhapatnam fishing harbour and Lawson's Bay (a coastal village with fishermen engaged mainly in hook and line fishing) were studied.

Landing of Yellowfin tuna by artisanal gears

Mean size and length at first maturity (L_m) of major species contributing to the fishery in Andhra Pradesh

Species	Gear	Mean size (cm)	L_m (cm)
Sardinella gibbosa	Trawl	15.2	14.5
	Gill net	15.2	
	Seines	7.4	
	All gears	12.3	
Rastrelliger kanagurta	Trawl	19.3	19.7
	Gill net	21.9	
	Seines	14.1	
	All gears	19.5	
Trichiurus lepturus	Trawl	53.4	37.0
	Seines	47.4	
	All gears	52.7	
Scomberomorus guttatus	Trawl	36.8	28.0
	Hook and Line	38.7	
	All gears	36.3	
Thunnus albacares	Hook and Line	111.4	100.0
Nemipterus japonicus	Trawl	18.8	12.8
Saurida undosquamis	Trawl	20.1	23.0
Upeneus vittatus	Trawl	14.1	13.8
Johnius carutta	Trawl	16.1	15.4
Metapenaeus monoceros	Trawl	13.3 (m), 15.3 (f)	9.5 (m), 11.5 (f)
Metapenaeus dobsoni	Trawl	8.4 (m), 9.4 (f)	6.8 (m), 8.8 (f)
Loligo duvauceli	Trawl	9.6	
Sepia aculeata	Trawl	15.8	
Sepia pharaonis	Trawl	16.5	

Traders carrying cephalopods on bicycles

Annual growth and mortality parameters of major exploited species in Andhra Pradesh

Species	L_α (cm)	K	Z	M	F	E
Sardinella gibbosa	19.1	1.5	5.41	1.5	3.91	0.7
Rastrelliger kanagurta	27.9	1.7	13.8	1.38	11.7	0.9
Trichiurus lepturus	115.0	0.2	1.8	0.4	1.40	0.8
Scomberomorus guttatus	67.7	1.2	2.44	1.63	0.81	0.33
Nemipterus japonicus	34.0	0.53	2.78	0.48	2.30	0.83
Saurida undosquamis	39.4	0.33	2.19	0.42	1.78	0.81
Upeneus vittatus	25.1	0.67	7.05	0.75	6.3	0.89
Johnius carutta	29.7	0.32	2.09	0.44	1.65	0.79
Otolithes ruber	45.0	0.20	0.90	0.29	0.61	0.68
Metapenaeus dobsoni						
(Male)	11.8	0.71	4.92	0.96	3.96	0.73
(Female)	12.2	0.81	3.91	1.03	2.88	0.81
Metapenaeus monoceros						
(Male)	18.9	1.35	6.7	1.27	5.4	0.91
(Female)	22.9	1.43	5.6	1.26	4.3	0.78

Stock estimates of major exploited species from Andhra Pradesh

Species	Spawning stock (t)	Standing stock (t)	Yield (t)
Sardinella gibbosa	150	584	27971
Rastrelliger kanagurta	82	331	21457
Trichiurus lepturus	95851	119051	18968
Scomberomorus guttatus	956	1260	4993

PROJECT CODE MF / CAP /02

PROJECT TITLE **Building trophic models and fisheries management simulations for the Indian Seas: Part 1 - Northwest coast (NWC) and Gulf of Mannar (GOM) ecosystems**

SCIENTISTS **K.S. Mohamed,** M. Srinath, E. Vivekanandan, P.U. Zacharia, T.V. Sathianandan, V.D. Deshmukh, M.Z. Khan, V.V. Singh, Paramita Banerjee, K.V.S. Nair, P.K. Asokan, S. Ghosh, V. Venketasan, Bindu Sulochanan, E.M. Abdussamad, K.K. Joshi, P.S. Asha

CENTRES Cochin, Mumbai, Veraval, Chennai, Mandapam Camp and Tuticorin

Northwest Coast (NWC) Ecosystem

Habitat Area: Area between shoreline and 90 m depth on the continental shelf off Jakhau in Gujarat (22°28'N-68°20'E) and Harnaii in Maharashtra (17°50'N -70°52'E) was taken as the habitat area covering 1,57,320 km^2. This ecosystem has at least 3 sub-ecosystems, viz., the Gulf of Kutch and the Gulf of Cambay and the shelf area outside the gulfs.

Ecological Groups & Fleets: Initially 26 ecological groups were considered in the first workshop for NWC but subsequently in the second workshop the number was reduced to 22 mainly due to merging of some groups and inadequacy of information on reef fishes and birds even from the secondary sources. From FRAD data, 24 craft-gear combinations were observed, and these were reduced and unified to 7, viz., mechanize trawl net (MTN), multi-day trawl nets (MDTN), mechanized purse seines (MPS), mechanized hook and line (MHL), mechanized *dol* net (MDOL), mechanized gillnets (MGN) and artisanal gears (ART).

Ecopath Data Input Collation: The input parameters such as fleet-wise and ecological group-wise catch data, biomass estimates, P/B estimates and Q/B estimates were derived for all fishery and non-fishery groups for use as input in Ecopath software. The estimated and collated data are presented in tables. The input values of the model now need validation before trial runs.

Fleet-wise and group-wise total catch in tonnes/ km^2 in NWC ecosystem averaged for 2005 and 2006

Grp No	Group name	MTN	MDTN	MDOL	MGN	MHL	ART	MPS	Total	%
1	Large pelagics	0.0057	0.0352	0.0034	0.1419	0.0015	0.0001	0.0166	0.2044	4.30
2	Large benthic carnivores	0.0056	0.0768	0.0051	0.0197	0.0019	0.0001	0.0014	0.1106	2.33
3	Rays & Skates	0.0017	0.0176	0.0017	0.0077	0.0000	0.0000	0.0000	0.0287	0.60
4	Medium benthic carnivores	0.0173	0.1609	0.0434	0.0669	0.0056	0.0003	0.0052	0.2996	6.30
5	Small benthic carnivores	0.0454	0.5634	0.0552	0.0687	0.0044	0.0015	0.0009	0.7395	15.56
6	Midwater carnivores	0.0720	0.4706	0.1457	0.1403	0.0003	0.0001	0.0179	0.8468	17.81
7	Bombayduck	0.0170	0.0774	0.3952	0.0008	0.0000	0.0002	0.0000	0.4906	10.32
8	Small pelagic herbivores	0.0002	0.0045	0.0025	0.0098	0.0000	0.0000	0.0011	0.0181	0.38
9	Small pelagic carnivores	0.0215	0.1056	0.0970	0.0833	0.0000	0.0006	0.0123	0.3203	6.74
10	Cephalopods	0.0221	0.3608	0.0028	0.0006	0.0000	0.0000	0.0001	0.3864	8.13
11	Benthic omnivores	0.0060	0.0263	0.0111	0.0086	0.0000	0.0043	0.0000	0.0563	1.18
12	Non-penaeid shrimps	0.0302	0.1308	0.6005	0.0013	0.0000	0.0002	0.0000	0.7631	16.05
13	Penaeid shrimps	0.0295	0.2693	0.0713	0.0013	0.0000	0.0007	0.0000	0.3719	7.82
14	Crabs & lobsters	0.0070	0.1028	0.0038	0.0033	0.0000	0.0003	0.0000	0.1172	2.47
	Total								4.7537	100

Biomass, P/B and Q/B estimates for fishery groups of NWC ecosystem

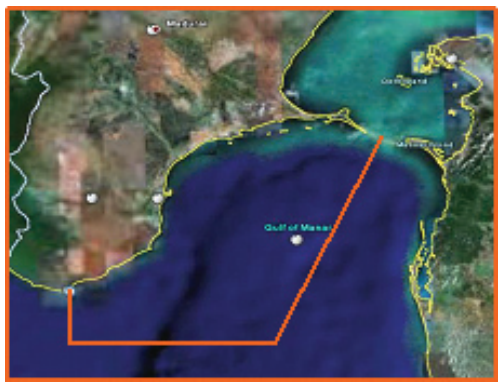
Ecological Group	Biomass (t km^2)	P/B per yr	Q/B per yr
1. Dolphins Porpoises	0.010	0.200	14.600
2. Large pelagics	0.040	3.420	17.980
3. Large benthic carnivores	0.070	2.210	6.110
4. Rays and Skates	0.063	0.750	5.980
5. Medium benthic carnivores	0.160	3.220	9.590
6. Small benthic carnivores	0.390	3.120	11.690
7. Midwater carnivores	0.330	3.500	11.410
8. Bombayduck	0.310	2.935	11.770
9. Small pelagic herbivores	0.030	2.800	15.000
10. Small pelagic carnivores	0.110	5.210	12.640
11. Cephalopods	0.060	5.500	36.000
12. Benthic omnivores	0.020	4.560	8.300
13. Non-penaeid shrimps	0.763	10.270	19.200
14. Penaeid shrimps	0.372	8.760	19.200
15. Crabs and lobsters	0.117	2.500	19.200
16. Whalesharks	0.013	2.429	0.080

Gulf of Mannar (GOM) Ecosystem

Habitat Area: Area of GOM was estimated as 19,000 km^2, the eastern boundary being the international border with Sri Lanka. This includes the 10,500 km^2, Gulf of Mannar Marine Biosphere Reserve (GOMMBR).

Biomass, P/B and Q/B estimates for non-fishery groups of NWC ecosystem

Eco Group	Biomass (t km^2)	P/B per yr	Q/B per yr
1. Benthic epifauna	14.5	3.9	15.0
2. Benthic infauna	24.0	19.0	5.5
3. Large zooplankton	0.192	60.0	300.0
4. Small zooplankton	0.288	35.0	25.0
5. Phytoplankton	25.9	118.3	
6. Detritus	169.89		



Ecological Groups & Fleets: Ecological groups were modified as 31 from the earlier 33. Maximum non-fishery groups (16 including detritus) were created for GOM. Turtle group was split into herbivorous (green turtle) and carnivorous (rest) based on feeding. 34 craft-gear combinations were consolidated into 7 fleets viz., MTN, MDTN, Bottom-set-gillnet (BSGN), DGN, H&L, Seines and Artisanal gears (ARS).

Ecopath Data Input Collation: The input parameters such as fleet-wise and ecological group-wise catch data, biomass estimates, P/B estimates and Q/B estimates were derived for most fishery and non-fishery groups for use as input in Ecopath software. The estimated and collated data are presented in table. The input values of the model now need validation before trial runs. Growth and mortality parameters (F, M, Z) of 148 species were estimated (P/B estimates); biomass and Q/B estimation of 30 species were completed; food and feeding of 67 species were studied and Index of relative importance (IRI) calculated.

Fleet-wise and group-wise total catch in tonnes/ km^2 in GOM ecosystem averaged for 2005 and 2006

	Ecogroups	MDTN	MTN	BSGN	DGN	H&L	SEINES	ARS	Total
1	Large pelagics	0.0088	0.0661	0.0047	0.1952	0.0527	0.0314	0.0158	0.3747
2	Medium pelagic carnivores	0.0114	0.1165	0.0033	0.1472	0.0126	0.0121	0.0088	0.3118
3	Large benthic carnivores	0.0143	0.1346	0.0201	0.1112	0.1456	0.0012	0.0094	0.4364
4	Rays & skates	0.0504	0.0581	0.0259	0.0319	0.0114	0.0002	0.0008	0.1789
5	Medium benthic carnivores	0.0830	0.2762	0.0114	0.0910	0.0088	0.0042	0.0097	0.4842
6	Small benthic carnivores	0.5268	1.0853	0.0142	0.1764	0.0026	0.0125	0.0205	1.8383
7	Small pelagic carnivores	0.0204	0.1132	0.0129	0.2138	0.0000	0.0466	0.0356	0.4426
8	Medium omnivores	0.0900	0.1024	0.0323	0.9133	0.0047	0.0294	0.0576	1.2297
9	Small pelagic herbivores	0.0043	0.0071	0.0870	0.1374	0.0000	0.1080	0.0020	0.3457
10	Crabs & lobsters	0.0291	0.0444	0.0584	0.0089	0.0002	0.0000	0.0166	0.1576
11	Shrimps	0.1046	0.1544	0.0104	0.0234	0.0000	0.0002	0.0022	0.2952
12	Reef fishes	0.0399	0.0758	0.0048	0.0130	0.0005	0.0004	0.0016	0.1359
13	Cephalopods	0.0436	0.1228	0.0003	0.0010	0.0170	0.0001	0.0041	0.1889
14	Filter feeding bivalves	0.0070	0.0016	0.0000	0.0005	0.0000	0.0000	0.0000	0.0092
15	Carnivorous invertebrates	0.0085	0.0049	0.0041	0.0009	0.0001	0.0000	0.0002	0.0187
	Total	**1.0421**	**2.3636**	**0.2898**	**2.0653**	**0.2562**	**0.2462**	**0.1848**	**6.4479**

Sponsored Projects

FUNDING AGENCY	**Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Govt. of India**
PROJECT TITLE	**Marine Fisheries Census -2005**
SCIENTISTS	Scientists of various Divisions
CENTRES	Cochin and All Regional and Research Centres

- Recognising the need for a strong real time and reliable database on various aspects of marine fisheries and the expertise and experience of CMFRI in conducting such massive census surveys, the DAHD&F, MOA entrusted the task of conducting the All India Marine Fisheries Census in the mainland to CMFRI with a funding support of Rs.80.50 lakhs.
- The entire census operation was carried out from 15th April to 15th May 2005 for the maritime States except Tamil Nadu and Pondicherry where the census was carried out during November-December 2005.
- Prof. (Dr.) Mohan Joseph Modayil, Director, CMFRI was the National Coordinator of the Census and Dr. M. Srinath, Head of Fishery Resources Assessment Division was the National Team Leader, who were ably supported by all the Scientists-in-Charge of Regional/ Research Centres of CMFRI.
- The All India Report of the Census was formally released by Shri. P.M.A. Hakeem, Secretary, DAHD & F, Ministry of Agriculture, Government of India on 25 July 2006 at Krishi Bhavan, New Delhi. The state-wise reports containing village-wise information were also released.

Sri. P.M.A. Hakeem, Secretary, Department of AHD and Fisheries releasing the Report on National Marine Fisheries Census, 2005, submitted by CMFRI, on 25 July 2006

Salient results

- There are 3,202 marine fishing villages with a total population of 3.52 million living in 7,56,212 households. The number of households per village on all India basis is 236 with a maximum of 543 in Kerala and a minimum of 50 in Goa. Women form 48.6% of the population with 948 females for 1000 males. This ratio is maximum in Kerala (980) and minimum in West Bengal (898). Nearly 56.5% of fisher folk are educated with varying levels of education.
- About 46.8% (1,645,919) of fisher folk are active fishermen engaged in fishery related activities. About 25.7% (889,528) of the fisher folk are actively engaged in fishing of which 80.7% (717,999) have fishing as a fulltime occupation. About 21.5% of fisher folk are engaged in fishing-related activities. Of this, those working as labourers form 29.2% and those associated with marketing are 27.4%.
- Among males, the major fishery related occupations are: labour (39.2%), mending of nets (28.6%) and marketing (14.0%). Among women, the major fishing associated activities are, marketing (41.8%), labour (18.4%) and curing/processing (18%). In 10% of the fisher folk families of Maharashtra, only women are involved in fishing or fishing allied activities and in all India level it is about 5%.

- There are 238,772 craft in the fishery of which 58,911 are mechanised, 75,591 are motorised and rest are non-motorised/non-mechanised. Out of 29,241 trawlers in the fishery, Gujarat (8,002) accounts for the maximum followed by Tamil Nadu (5,300), Maharashtra (4,219), Kerala (3,982) and other States. The maritime States on the east coast account for about 73% of the non-motorised/ non-mechanised craft; Andhra Pradesh (24,386) and Tamil Nadu (24,231) have the maximum number of these crafts. Out of 185,438 craft owned by fisher folk, 35,806 are mechanised, 52,971 motorised and 96,661 are non-motorised/non-mechanised. Nearly 47% of the fisher families involved in fishing neither own any craft nor gear. In the maritime States, Kerala has 66% of such families, followed by West Bengal (49%), Tamil Nadu (46%) and others.

FUNDING AGENCY	**Ministry of Earth Sciences**
PROJECT TITLE	**Tuna Resources of the Indian EEZ - an assessment of growth and migratory patterns (Collaboration with FSI)**
SCIENTISTS	**N.G.K. Pillai,** U. Ganga and K.P. Said Koya
CENTRE	Cochin and Minicoy

- Assessment of stock, including growth and migratory patterns of tuna by different craft-gear combinations at Cochin, Minicoy and Agatti was carried out.
- Catches at Minicoy and Agatti were mainly landed by pole and line, and drift gill nets at Cochin. *K. pelamis* contributed 93 and 99% of the total tuna landings at Minicoy and Agatti, respectively and the rest was by the yellowfin *T. albacares*.

Landing of Yellowfin tuna

- Peak landings occurred during October - December in the Lakshadweep seas. Compared to open sea fishery, CPUE in FAD fishery was higher during February - June.
- Growth parameters of skipjack tuna were estimated as L_{α} = 74 cm and K = 0.9. Length converted catch curve indicated the fishing mortality (F) as 3.39, total mortality (Z) as 5.21 and exploitation rate (E) to be 0.64 in the pole and line fishery.
- Jones Length Cohort analysis indicated a yield of 7441 t and standing stock biomass of 9184 t with relative yield per recruit highest at an exploitation rate of 0.6. Thompson and Bell analysis indicated fishing effort by the existing pole and line units have attained near optimum and maximum increase in fishing effort is limited to 20 % of existing effort to attain Maximum Economic Yield (MEY).
- DNA was isolated from *K. pelamis* and *T. albacares* landed at Cochin Fisheries harbour, caught from Lakshadweep waters (Minicoy and Agatti) and also from International waters (lat 22Ú and long 68Ú). Cytochrome-b gene of mt DNA of *K. pelamis* and *T. albacares* were amplified with universal primer and used for studying the stocks and mixing patterns.
- Truss analysis of skipjack caught at the three localities was also done to study stock structure and mixing patterns. A book entitled *Bibliography on tunas* was released.

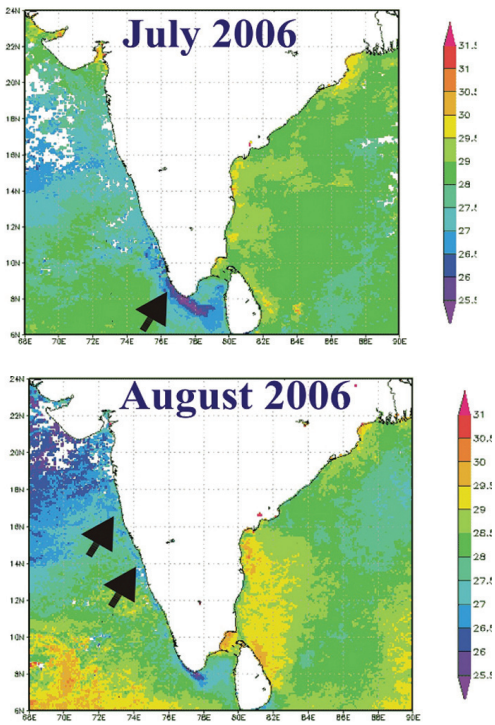
FUNDING AGENCY	**Ministry of Earth Sciences**
PROJECT TITLE	**Stock assessment and biology of deep-sea fishes in the continental slope of Indian EEZ**
SCIENTIST	**A.A. Jayaprakash**
CENTRE	Cochin

- Three deep-sea fishing surveys in the 500-1000m depth zone off east coast, southwest coast and Andaman waters have been carried out during the *Sagar Sampada* cruises Nos. 247, 250 and 252.
- A total of 111 species of finfishes, 9 species of shrimps, 3 species of crabs, 4 species of squids and one glass sponge have been recorded. The catch/hr of upper and lower east coast was 388kg and 362kg, respectively. Catch/hr off Andaman was 58kg and southwest coast was 232kg. Transect-wise distribution of deepsea resources and new deepsea shrimp grounds have been identified and potential fishing grounds area identified.
- The distribution of deep-sea shrimps has indicated similarity in both east and west coasts and some of the large growing shrimps like *Acanthephyra armata* has shown great potential for exploitation. An important feature was the occurrence of deep-sea glass sponge *Monorhaphis chuni* in the mud flats off Mangalore.

Acanthephyra armata

Marine Environment

PROJECT CODE	**FEM/01**
PROJECT TITLE	**Monitoring the environmental characteristics of the inshore waters in relation to fisheries**
SCIENTISTS	**V. Chandrika,** P.K. Krishnakumar, V.V. Singh, P.S. Asha, Bindu Sulochanan and K. Vijayakumaran
CENTRES	Cochin, Mangalore, Mumbai, Minicoy, Veraval, Mandapam Camp, Tuticorin, Chennai and Visakhapatnam



Mean sea surface temperature (SST) map of the Arabian Sea & Bay of Bengal (MODIS 9-km spatial resolution data). Images were acquired using the GES-DISC interactive online visualization and analysis infrastructure (Giovanni). Arrows show the movement of upwelled water from southern tip to central west coast of India during July and August 2006.

- The main objective of the project is to study the environmental characteristics of the inshore sea from the east and west coast of India and its influence on pelagic fisheries. The important findings are:
- The sea surface water temperature in the inshore waters ranged between 23.0 and 33.5 oC in the west coast and between 23.8 and 32.6 oC in the east coat. Lowest seawater temperature was observed off Veraval (23 oC) while, highest temperature was observed off Mumbai (33.5 oC) in the west coast. Lowest seawater temperature was observed off Vishakhapatnam (23.8 oC) while, highest temperature was off Mandapam (32.6 oC) in the east coast.
- Salinity values ranged between 0.4 and 37.8 ppt in the west coast. Lowest salinity was observed in the near shore station near Mumbai (0.4 ppt) while the highest value was observed off Veraval (37.8 ppt). Salinity values ranged between 1.71 and 37.9 ppt in the east coast. Lowest value was observed in the near shore station near Chennai (1.71 ppt) while, the highest value was observed off Chennai (37.9 ppt).
- Dissolved oxygen (DO) content in seawater ranged from 0.01 to 8.9 ml/l in the west coast. Lowest DO value was observed off Mumbai (0.01 ml/l) while highest value was observed off Veraval (8.9 ml/l). The DO content ranged from 0.01 to 8.2 ml/l in the east coast. Lowest value was observed off Chennai (0.01 mg/l) while the highest value was observed off Vishakhapatnam (8.2 ml/l).
- The chlorophyll 'a' concentrations ranged between 0.01 and 13.3 mg/m3 (mean 2.52 mg/m3) in the west coast, while in the east coast it ranged between 0.01 to 19.5 mg/m3 (mean 2.52 mg/m3). The zooplankton biomass at Mangalore ranged from 1.21 to 21.8 ml/m3 (mean 7.64 ml/m3) while at Mandapam Camp, it ranged from 27 to 140 ml/m3 (mean 62.8 ml/m3).
- Significant positive correlations were observed between the field measured Sea Surface Temperature (SST) and satellite derived SST from the inshore waters at Cochin (R2= 0.73), Mangalore (R2= 0.80), Vishakhapatnam (R2= 0.81), Mandapam Camp (R2= 0.65) and Tuticorin (R2= 0.72).
- Field and satellite derived oceanographic data have shown that coastal upwelling occurs during July - September with a peak in August resulting in high nutrient concentrations and biological productivity along the south west coast. Nearly 70% of the pelagic fish catch,

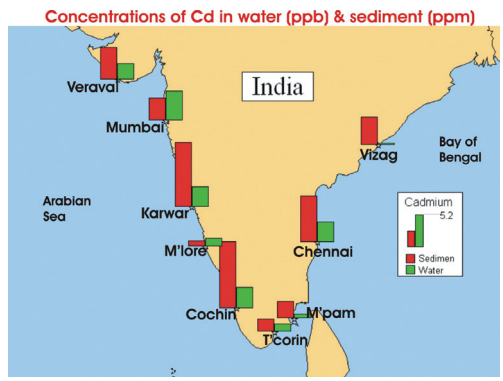
dominated by oil sardine and mackerel was obtained during September-December, during or immediately after the upwelling season.

- Total pelagic fish catch in purse seine and drift gill net, and catches of fishes such as carangids, mackerels, seerfishes and tunas showed significant positive correlation with bottom sigma t and significant negative correlations with bottom dissolved oxygen content (upwelling indicators) at Mangalore.

PROJECT CODE	**FEM/02**
PROJECT TITLE	**Monitoring environmental contaminants from coastal waters with reference to bioaccumulation and biomagnification in fishes**
SCIENTISTS	**P.K. Krishnakumar,** P. Kaladharan, D. Prema, V.V. Singh, K. Vijayakumaran, P.S. Asha and Bindu Sulochanan
CENTRES	Mangalore, Cochin, Mumbai, Tuticorin, Mandapam Camp and Visakhapatnam

The main objective of the project is to assess the environmental impact of anthropogenic activities along the coastal waters of India and to monitor levels of heavy metals and its bioaccumulation in biota. The important observations are:

- Trace metal concentrations in sediment samples collected from estuarine and inshore region off Cochin were within the permissible limits. Concentrations of Cd was relatively high in sediment samples collected from the hotspots in Edayar, Varapuzha, Chitrapuzha and Champakkara in the Vembanad Lake. Concentration of Zn was also relatively high in sediment of Edayar.
- Environmental monitoring in the inshore waters off Mangalore receiving the effluent from industries like the fertilizer plant, iron ore processing plant, dyes and pigment processing plant and an oil refinery were carried out. Generally, the observed parameters were within the permissible limits.
- Environmental monitoring in the Tuticorin Bay which receives the effluents from the M/s. Tuticorin Thermal Power Plant (TTPP) and in the lagoon which receives the effluents from M/s. Dharangadhare Chemical Works Ltd., (DCW) and M/s. Plastic Resins and Chemical Ltd., were continuously monitored. Relatively high concentrations of lead were observed in seawater, sediment and bivalves collected from these hotspots in Tuticorin.
- Cadmium concentrations were relatively high in cephalopod samples when compared to fish samples collected from Veraval. Generally, the observed metal concentrations in the samples were within the safe limits.
- Seawater and sediment samples collected from locations close to industrialized areas in Mumbai, Cochin, Chennai, Tuticorin and Veraval were relatively contaminated with toxic trace metals such as cadmium, lead, zinc and copper (Fig). Toxic metal concentrations in sediment were 1,700 - 4,500 times higher when compared to the concentrations observed in seawater.
- Toxic metal concentrations in most of the commercially important fishes were within the safe limits. Toxic metal bioaccumulation in

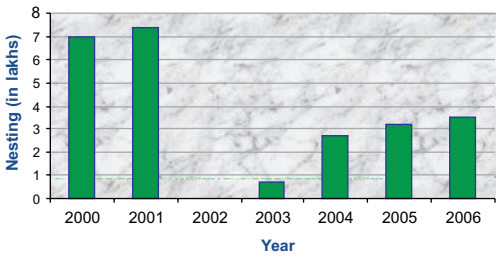


Cadmium concentrations detected in water and sediment samples collected from the coastal waters of India.

fish liver tissue was nearly 1.4 - 3.6 times higher when compared to the muscle tissue.

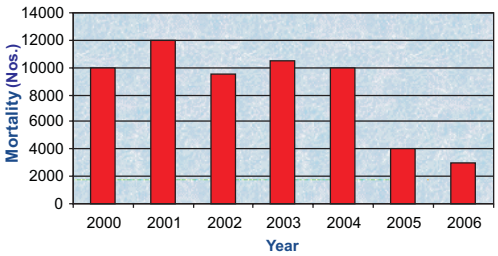
- In case of cadmium, highest Bioconcentration factors (BCFs) of 4,060 was observed in cephalopods while for Cu highest value of 157 was observed in shrimps. Highest BCF of 4,934 for Pb was observed in cephalopods.

PROJECT CODE **FEM/04**
PROJECT TITLE **Development of strategies for sea turtle and sea cucumber conservation**
SCIENTISTS **M. Rajagopalan,** K. Vijayakumaran and P.S. Asha
CENTRES Cochin, Visakhapatnam and Tuticorin



Mass nesting of Oliveridley along Orissa coast

- Mass nesting or '*arribada*' along Orissa coast in 3 nesting areas, Bhitarkanika, Devi river mouth and Rushikulya occurred during 2006. Nearly 3.2 lakhs of Olive ridley *Lepidochelys olivacea* were estimated in the above 3 mass nesting sites during 2005 and 3.5 lakhs in March 2006.
- During 2006, reported mortality of olive ridley in fishing gear along the Northern Orissa coast was 3,000 when compared to 4,000 in 2005 season.
- Juveniles of *Holothuria scabra* reared in sand bed and fed with *Sargassum* sp. registered higher growth than those reared in bare tank bottom.
- Egg suspension from eviscerated female *H. scabra* was found to be an effective spawning inducing agent.
- The optimum hatching condition for maximum hatching rate of 0.5 eggs/ml was achieved at a salinity of 35ppt.



Mortality of Oliveridley along Orissa coast

- Highest survival, growth rate and fastest development of auricularia of *H. scabra* were obtained at a stocking density of 1arva/ml and between 33-35ppt salinity.
- Spawning trials attempted for *H.scabra* (mean wt 500gm) were disrupted due to skin disease outbreak.
- Juveniles of *H. scabra* measuring 5-10mm total length were more susceptible to disease like skin lesion whereas juveniles of >10mm are comparatively resistant to such diseases.
- 1200 young ones of *H. scabra* of mean size 25mm were released in the sea grass bed at Tuticorin.

PROJECT CODE **FEM/07**
PROJECT TITLE **GIS based atlas on potential mariculture sites along the Indian coast**
SCIENTISTS **V. V. Singh,** S. Jasmine, P.K. Krishnakumar, Gulshad Mohammed, Reeta Jayasankar, P.S. Asha, Bindu Sulochanan, Rani Mary George and K. Vijayakumaran
CENTRES Mumbai, Karwar, Mangalore, Calicut, Cochin, Tuticorin, Mandapam Camp, Chennai and Visakhapatnam

- The project was implemented on the West and East coast of India. Potential mariculture sites were identified and attributes were collected after shortlisting of sites by process of elimination and selection.
- In Maharashtra, Nevri site off Ratnagiri was recommended for open sea cage culture. A site off Mandapam in Palk Bay was identified for open sea cage culture.

- Seven potential mariculture sites from Kunjathur at Kasargod district to Ponnani Ferry in Malappuram districts were selected in northern Kerala and 11 stations viz., Edakkayur, Natika, Kullimuttom, Cherai, Puthuvyppu, Anthakaranazhi, Thumboli, Thirukunnapuzha, Thankacherry, Muthalapozhi and Poovar were selected in southern Kerala.
- After survey of Gulf of Mannar and Palk Bay region mariculture sites were selected at Thonithurai, Vedalai, Seeniappadharga, Sangmal, Olikuda, Ariyangundu, Thonithurai, Monikadu and Pillaimadam.
- At Tuticorin the five stations selected north of Palk Bay were Kallamozhi, Kulasekarapattinam, Veppalodai, Sippikulam and Vembar.
- Along the North Kannada district in Karnataka, five areas of 5-10 Km stretch each at Jali - Mavinkurve, Manki Bailur, Karki-Dhareswar, Gabbitthwada - Belumber and Gotenbhag - Bahole were identified as potential sites for mariculture. From Udupi and Dakshina Kannada Districts, locations such as Byndoore, North of Mulki and South of Mangalore were identified for mariculture.
- In Andhra Pradesh three stations were selected in Sarada Estuary. Kakinada Bay was identified for demonstration of pilot scale culture of bivalves. Depth Survey off Lawson's bay at Visakhapatnam was conducted for open sea cage culture demonstration.

Sponsored Projects

FUNDING AGENCY	**Department of Ocean Development**
PROJECT TITLE	**Studies on marine mammals of Indian EEZ and the contiguous seas**
SCIENTISTS	**M. Rajagopalan,** E. Vivekanandan, P. K. Krishnakumar, P. Jayasankar and K.P. Said Koya
CENTRES	Cochin, Mangalore, Mandapam Camp, Visakhapatnam and Minicoy

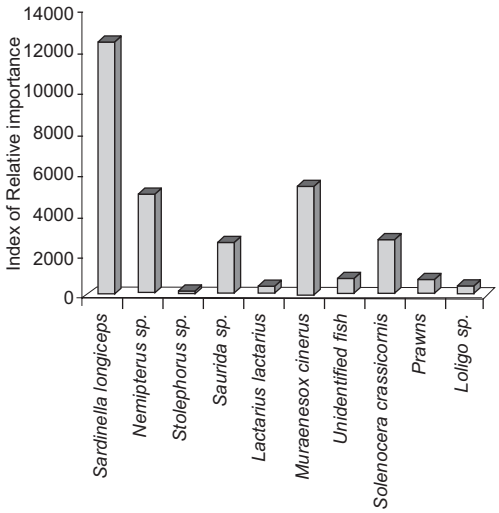
- During 2006-2007, 203 days were spent onboard FORV *Sagar Sampada* and made 106 sightings of marine mammals from Arabian sea, Bay of Bengal and Andaman sea (Cruise numbers 244-252).

Sightings of Cetaceans along the Indian coast

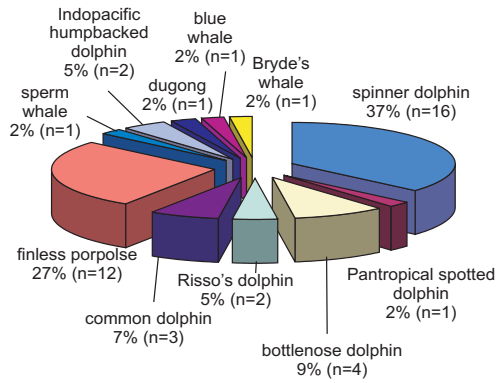
Cruise No.	Period	Duration of cruise (days)	No of sightings	Area of observation
244	15-04-06 to 04-05-06	20	7	Cochin–Porbunder- Goa Cochin(West coast)
245	30-05-06 to 20-06-06	22	32	Cochin-Paradeep- Chennai-Cochin (East coast)
246	26-06-06 to 07-07-06	13	2	Cochin-Trivandrum-Cochin(Southwest coast)
247	12-07-06 to08-08-06	28	6	Cochin-Paradeep-Tuticorin (East coast)
248	12-08-06 to01-09-06	21	4	Tuticorin-Andamans-Cochin(Andaman Sea)
249	15-09-06 to21-10-06	37	18	Cochin-Paradeep-Visakhapatnam-Cochin (East coast)
250	30-10-06 to 10-11-06	12	6	Cochin-Mumbai-Cochin (West coast)
251	29-11-06 to20-12-06	22	6	Mangalore-Veraval-Cochin (West coast)
252	17-01-07 to 13-02-07	28	25	Cochin-Mangalore-Andamans-Cochin (Andaman sea)

- Stranding of five baleen whales, a Bluewhale *Balaenoptera musculus*, a Bryde'swhale (*Balaenoptera edeni)* and three *Balaenoptera* spp. were reported from Mandapam. Stranding of one

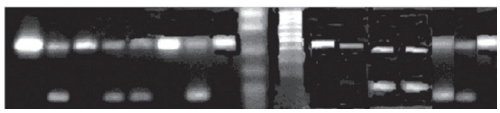
Stranded *Balaenoptera musculus* at Mandapam



Prey of finless porpoise, spinner dolphin, Indo-pacific humpbacked dolphin and long beaked common dolphin



Updated status of DNA repository of marine mammals at CMFRI



PCR-based gender identification of marine mammals - *SRY* and *ZFX/ZFY* specific bands (indicated by arrows) in different species: 1, NPHO female; 2, NPHO male; 3, SLON female; 4, SLON male; 5, TADU male; 6, TADU female; 7, SCHI male; 8, SCHI female; M, DNA size markers; 9, GGRI female; 10, DDUG female; 11, BMUS male; 12, BEDE male; 13, GGRI male; 14, SATT male; 15, PMAC female.

dolphin (species unknown) and a sea cow were also reported from Mandapam.

- The stomach contents of 32 animals of seven species consisting of 11 finless porpoise (*Neophocaena phocaenoides*), 13 spinner dolphin (*Stenella longirostris*), two bottlenose dolphin (*Tursiops aduncus*), two Indo-pacific humpbacked dolphins (*Sousa chinensis*), two Risso's dolphin (*Grampus griseus*), one pan tropical spotted dolphin (*Stenella attenuata*) and one long beaked common dolphin (*Delphinus capensis*) were examined.
- The relative importance of each prey species was assessed through *Index of relative importance* and *Diversity indices*.. The stomach of 24 individuals was empty and in the remaining eight individuals, 666 prey items comprising 6 species of teleosts, one crustacean and one squid species were identified from the food remains.
- Tissue samples of various species collected from Visakhapatnam, Mangalore and Chennai were analysed for mercury. Mean concentration of mercury in the liver *Stenella longirostris* (10.43 µg/g WW) and *N. phocaenoides* (2.58 µg/g WW) were greater than those of kidney of *S.longirostris* (0.68 µg/g), *N. phocaenoides* (1.38 µg/g) and muscle of *S.longirostris* (0.49 µg/g WW), *N. phocaenoides* (1.67 µg/g).
- Dugong tissue samples collected from Mandapam were analysed for pesticides. Concentration of ∑HCHs was found to be 18.50ng/g.∑Chlordanes concentration in sea cow was 2.50 ng/g and ∑DDT concentrations was 15.10ng/g. DDE/DDT ratio in sea cow was 0.06ng/g. ∑DDT/∑HCHs ratios in sea cow was 0.82.
- A total of 24 partial mitochondrial DNA sequences from 19 individuals of 8 marine mammal species were submitted to the Gene Bank (NCBI) during 2006-07.
- Molecular taxonomy technique was successfully applied to ratify species identity of one beach cast blue whale (*Balaenoptera musculus*), and a Bryde's whale (*Balaenoptera edeni*), which had decayed beyond recognition. Application of PCR-based gender identification method developed by the institute determined the sex of *B. edeni* as male and also ratified sex determination of *B. musculus* based on external genitals.
- Molecular sexing was standardized in Bottlenose dolphin, Spinner dolphin, bridled dolphin, Indo-Pacific humpbacked dolphin, Risso's dolphin, Finless porpoise, sperm whale, blue whale, Bryde'swhale and dugong.
- Population genetic comparison of Indian samples of spinner dolphin was carried out with those from Northern Australia, Maldives, Taiwan, Hawaii island, Timor sea, Philippines, Pacific Ocean, Atlantic Ocean, etc. Phylogenetic analyses of all samples of the present study, "SSTD" (*Sousa-Stenella-Tursiops-Delphinus*) complex and specifically those of spinner dolphin were carried out and compared the Neighbor joining, Maximum parsimony and Maximum likelihood algorithms.

FUNDING AGENCY	**ICAR (National Network Project of NRM Division)**
PROJECT TITLE	**Impact, adaptation and vulnerability of Indian Fisheries to climate change**
SCIENTISTS	**M. Rajagopalan,** E. Vivekanandan, N.G.K. Pillai, M. Srinath, Rani Mary George, P.K. Krishnakumar, P. Kaladharan, Reeta Jayasankar and K. Vijayakumaran
CENTRE	Cochin, Mangalore, Chennai and Visakhapatnam

Vulnerability of coral reefs

- From the SRES A2, monthly data on sea surface temperature (SST) for 2000-2099, the Degree Heating Months (DHM) were estimated for Andaman & Nicobar, Gulf of Mannar, Lakshadweep and Gulf of Kutch reef regions. Based on the DHMs and the past experience of the 1998 and 2002 bleaching events, the bleaching events to rising seawater temperature were projected for the years 2000-2099.

Trends in sea surface temperature

- Sea Surface Temperature along the Indian coast at different time intervals was mapped to study the trend in increase. ICOADS sea surface temperature data (obtained from ESRL PSD www.cdc.noaa.gov) and 9-km resolution monthly SST obtained from AVHRR satellite data (provided by the NOAA/NASA from their website at http://podaac.jpl.nasa.gov/) was used.

Adaptation of oil sardine

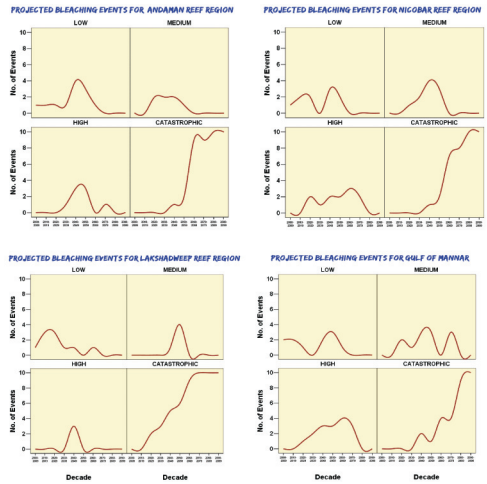
- The oil sardine *Sardinella longiceps*, which contributes the maximum to marine fish catch in India is found to extend its distributional range to the northern latitudes in the Arabian Sea and Bay of Bengal. In 1961-1976, more than 50% of the all India sardine catch was from 8º-11ºN latitude, 25-50% from 11º-15ºN and <1% from 15º-20ºN along the west coast. The catch was very low or nil along the east coast. In 1997-2006, the distributional range has spread, with more than 50% of the all India sardine catch continuing from 8º-11ºN latitude, 10-25% from 11º-15ºN and 1-10% from 15º-20ºN along the west coast; while it is 10-25% from 8-13ºN, 1-10% from 13-19ºN and <1% from 19-21ºN along the east coast.

Adaptation of threadfin breams

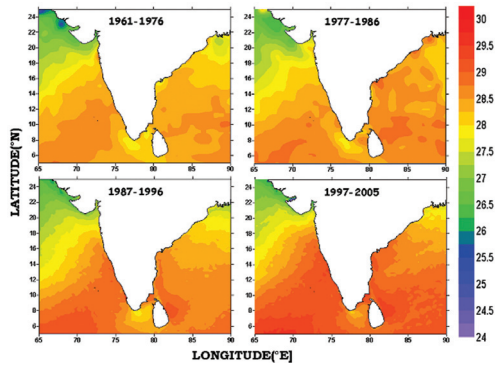
- It is found that the spawning season of two dominant species of threadfin breams *Nemipterus japonicus* and *N.mesoprion* is shifting towards cooler months off Chennai. In 1980, 38% of annual spawning was in the warmer months of April-September (SST: 29-29.5ºC) and 62% in cooler months of October-March (SST: 27.5-28ºC). In 2004, only 5% of annual spawning was in warmer months and the remaining 95% was in cooler months.

Vulnerability of coastal fishing villages

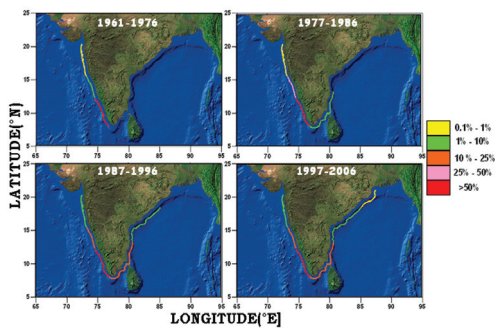
- Stakeholder interviews and survey of ten coastal fishing villages were carried out. Dimension Indices (DI) and vulnerability Indices (VI) were worked out by considering 31 factors under 7 dimensions on a seven-point scale (1-7). Among the villages considered, Gokarkuda in Ganjam district of Orissa was the most vulnerable (VI: 0.53) and BCV Palem in Andhra Pradesh was the least vulnerable (VI: 0.16). Among the dimensions of vulnerability, the demography, food security and habitat induced maximum vulnerability to climate change with average index above 0.50.



The projected bleaching events at Andaman & Nicobar, Gulf of Mannar, Lakshadweep and Gulf of Kutch during each decade for the period 2000-2099.



The sea surface temperature trends during different time intervals

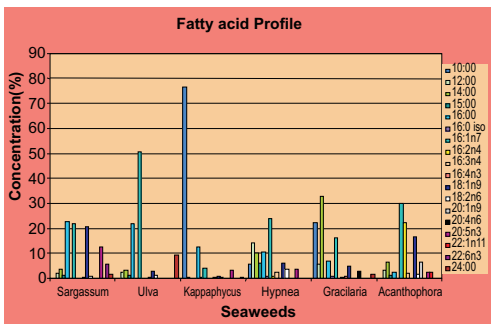


Extension of northern boundary of oil sardine (the colored lines indicate percentage of all India oil sardine production)

FUNDING AGENCY	**ICAR AP Cess Fund**
PROJECT TITLE	**National risk assessment programme for fish and fish products for domestic and international markets**
SCIENTISTS	**D. Prema and** N. K. Sanil
CENTRE	Cochin
COLLABORATING INSTITUTE	CIFT, Cochin

- There is no significant seasonal variation in the concentration of heavy metals in the bivalves studied. In general, the heavy metal concentrations in the bivalves of Kerala were within the permissible limits stipulated by WHO standards.
- Bivalves analysed for organochlorine pesticides and all the values were below the stipulated limits of WHO. No consistent seasonal variation in the concentration of various organochlorine pesticides was noticed.
- While considering the risk with parasites, all the bivalves examined were fully free of hazard due to parasites of sanitary significance.
- Organisms of phytosanitary significance were observed in different bivalves of Kerala (ectocommensal ciliates, *Ricketsia* like organisms, *Stegotricha* sp., *Trichodina* sp., gregarian spores, nematodes, turbellarians *Polydora ciliate*, trematode metacercaria, polychates, isopods, copepods, *Pinnotherus* sp., amphipods, barnacles, *Modiolus* sp., Pistol shrimp).

FUNDING AGENCY	**ICAR AP Cess Fund**
PROJECT TITLE	**Cattle feed production from selected seaweeds of Indian coasts**
SCIENTISTS	**P. Kaladharan,** S.N. Rai, Dinabandhu Sahoo
CENTRES	Cochin, Karnal, Delhi
COLLABORATING INSTITUTE	NDRI and Delhi University



Fatty acid profile of six species of seaweeds

- Regeneration of seaweeds harvested by cutting (100%) was higher than compared to hand picking (50-60%).
- The brown seaweed, *Sargassum wightii* contained maximum amount of Omega-3 fatty acids whereas red seaweeds *Hypnea* and *Gracilaria* contained higher levels of Omega-6 fatty acids.

Socio-economics and Extension

PROJECT CODE	**SEE / PMS/ 01**
PROJECT TITLE	**Price behaviour and marketing system of marine fisheries in India**
SCIENTISTS	**R. Sathiadhas** and R. Narayanakumar
CENTRES	Cochin, Veraval, Mumbai, Karwar, Mangalore, Calicut, Vizhinjam, Tuticorin, Mandapam, Chennai, Kakinada and Visakhapatnam

- The analysis of price behaviour of different varieties indicated that the varieties like sharks, rock cods, snappers, pomfrets, seer fish, crabs maintained a consistent wholesale price during the year.
- In case of retail prices, varieties like sharks, cat fishes, anchovies, rock cods, snappers, croakers, Pomfrets, and crabs maintained a consistent price . The high quality varieties maintained steady price level at both the wholesale and retail market due to their high consumer preference.
- The analysis of price stability of different varieties indicated that varieties like seer fish (CV of 8.15% in wholesale market & CV of 6.87% in retail market), sharks (9.05% & 9.67%) and rock cods (8.99% & 9.30%) maintained a stable price in both wholesale and retail markets during the year.
- The analysis of market integration, which measures the extent of concurrence in fish price movements along different markets, indicated that varieties like sharks (correlation coefficient of 0.664), rock cods (0.791), croakers (0.857) and seer fish (0.611) had a comparatively strong degree of association between the landing centre and retail market prices.
- The marketing efficiency assessed by working the percentage share of fishermen in the consumer rupee (PSFCR) indicated that the PSFCR was the highest for pomfrets-*P.argentitus* during the year at 79.79 % during April-September and 72.75 % during October-March. Varieties like seer fish (64.96% & 65.60%), pomfrets-*P.niger* (58.48% & 59.87%), crab - *P. pelagicus* (57.89% & 58.66%), rock cods (56.16% & 54.15%), snappers (57.77% & 54.96%) earned over 50 per cent of the consumer rupee to the producer during 2006-07.
- The value of marine fish landings increased from Rs.11,008 crore in 2005 to Rs.13,287 crore in 2006 at the point of first sales. The valuation of marine fish landings at the point of last sales increased from Rs.18,618 crore(2005) to Rs.22,236 crore (2006). For exportable varieties increase in value at first sales itself was 2 % for penaeid shrimps and 11% for cephalopods compared to the last year. Increase in PSFCR of all varieties indicate increase in internal marketing efficiency. Shrimps and cephalopods still contribute more than 50% of income generated from fisheries product diversification.

Retail price data collection

PROJECT CODE	**SEE / ECO/ 01**
PROJECT TITLE	**Economics of marine fishing operations**
SCIENTISTS	**R.Narayanakumar** and R.Sathiadhas
CENTRES	Cochin, Veraval, Mumbai, Karwar, Mangalore, Calicut, Vizhinjam, Tuticorin, Mandapam, Chennai, Kakinada and Visakhapatnam

Fish catch by motorised boats

- At the national level, the capital productivity of MDF (2-5days) trawling (0.62) and the labour productivity (293 kg) were highest among the different gears operated. The capital productivity was the highest in AP, and the labour productivity was the highest in Kerala.
- At national level, fuel and crew wage accounted for 86-90% of operating cost/trip for all mechanized fishing operations and accounted for more than 82% of the variation in the dependent variable namely the gross revenue per trip.
- At macro level, in the motorized sector, the capital productivity (0.60) & labour productivity of multi-day gillnets were the highest among all the gears operated.
- The non-mechanized gill net operation recorded the most efficient capital productivity (0.46) and labour productivity (63kg) among the different gears operated.
- In Visakhapatnam zone, the capital productivity of MDF (5-10 days) was more efficient with the lowest operating ratio of 0.52, compared to other fishing methods like SDF (0.55), MDF (2-5days) at 0.64 and MDF (>10 days) at 0.64.
- In terms of labour productivity also, MDF (5-10 days) had the highest catch per crew per trip at 515kg as compared to 191kg in MDF (2-5days), 465kg in MDF (>10days).
- During 2006-07, the multi-day fishing of 5-10 days duration has performed economically better than the other fishing methods in Vishakhapatnam.
- The multi-day fishing method (> 10 days) supports livelihood of maximum nine crew members in the direct employment, followed by other fishing methods. On an average about 3-5 fish worker's families are supported by the mechanized crafts in the secondary and tertiary services.

PROJECT CODE	**SEETTD/ IM / 01**
PROJECT TITLE	**Impact of management and technological interventions on marine fisheries and coastal livelihood**
SCIENTISTS	**R.Sathiadhas,** E. Vivekanandan, M.Srinath, R.Narayanakumar, Sheela Immanuel, C.Ramachandran, Vipinkumar.V.P and P.S. Swathilakshmi
CENTRES	Cochin, Veraval, Mumbai, Karwar, Mangalore, Calicut, Vizhinjam, Tuticorin, Mandapam, Chennai, Kakinada and Visakhapatnam

The impact of management and technological interventions such as the monsoon ban in fishing in AP, West Bengal and Kerala, FADs and deep sea shark & tuna fishing by migratory fishermen of Tamil Nadu, tuna value chain and data buoys deployed in Lakshadweep islands, co-operative marketing and regulation of minimum legal size for marketing in Maharashtra and Gujarat were studied. Some of the highlights are :

- The estimated economic loss due to trawl ban in Kerala in terms of gross revenue was Rs 204.36 crores and net income was Rs 43.29 crores and the employment loss to fishing labourers was 9,63,996 man days resulting a wage loss of Rs 8.74 crores.
- Impact of labour migration in shark fisheries in Thoothoor, Vallavilai and Colachel regions in Tamil Nadu revealed 35 % were non-migrants (local fishing), 50 % were migrants (within the country) and 15 % were foreign migrants. The common problems encountered in these 3 regions by migrant fisherfolk were insufficient landing and berthing facilities, inability to realise competitive prices due to lack of common landing points, rivalry and frequent conflicts among villages in resource sharing, domestic fishers face restrictions in fishing while foreign vessels are permitted and vulnerability and problem of debt trap of local money lenders and traders. The major factors inducing migration of fishermen are high demand for shark in international market and its earning potential, accessibility to landing points and berthing facilities in other states and better price realisation of produce.
- The analysis of impact of monsoon trawl ban on employment pattern revealed that while fishery was the predominant occupation during the ban period, 30 per cent of the household members of supporting service providers worked in non-fishery enterprises.
- In both the States of Andhra Pradesh and West Bengal, there is complete (cent percent) agreement that the monsoon ban should continue and it should be uniformly implemented along the coast instead of different periods. The respondents also agreed in total that there is an increase in catch after the ban period.
- In Vishakhapatnam region of Andhra Pradesh, artisanal fishermen reported that ban should be continued, 96 % reported enhanced catch of 30-50% after ban, 80% reported present ban period is optimum, 20% reported it should be extended to 60 days and 42% stated it should be uniform in all the states.
- In Orissa region, regarding the impact of ban, 49% of the motorized fishermen reported that trawl ban leads to higher catch and 85% of the non motorized fishermen from Orissa stated that trawl ban should be continued. Similarly the analysis of the performance difference between wooden catamaran and fibre teppa boats indicated that the longevity of wooden boat was for 3 to 5 years while it was more than 10 years for fibre teppa.
- In Tamil Nadu, Artificial reef structures (ARS) have gained popularity following the efforts made by CMFRI and NGOs. During the ban period, 40% of the trawl owners, 66% of the crew members and 58% of the service providers, found employment in non-fishery enterprises. The perceived catch increase due to FADs in the selected villages such as Chinnandikuppam, Chinnaneelankarai Kuppam, Thazhanguda and Vembar is to the tune of 48 %.
- In Karnataka, the prioritized management interventions were closed season and weights & measures. Results showed that all respondents supported closed season and 97% of respondents are following the weights and measures stipulated among wholesalers.

Boats berthed in interior regions during ban period

Awareness assessment of fishing regulations

Women in fish marketing

Socio-economic assessment

- The detailed survey in Veraval of Junagad district and Rajpara of Amreli district in Gujarat revealed closed season, mesh size and fishing regulations, introduction of weights & measures as the major interventions. 87.44 % in primary sector, 93 % in secondary sector and 91.5 % in the tertiary sector supported trawl ban. Awareness on fishing regulations was only 11.43 % in primary sector, 9.33 % in secondary sector and 8.5 % in the tertiary sector in Gujarat.
- The survey in Versova of Greater Bombay district & Uttan of Thane district in Maharashtra revealed closed season, mesh size and fishing regulations, shark fishing by migratory fishermen, packaging and labeling and Introduction of weights & measures as the major interventions. 89.13 % in primary sector, 93.5 % in secondary sector and 89.33 % in the tertiary sector supported trawl ban.
- The detailed study in Vizhinjam and Munambam in Kerala revealed closed season, fish aggregating devices, ban on night trawling and mesh size regulation as major interventions. Regarding their attitude towards effects of ban, it was seen that 46% in the mechanized sector, 92 % in the motorized sector, 98 % in the traditional sector and 65 % in secondary sector opined MTB was effective.
- The study in Lakshadweep revealed Data Buoys as Fish Aggregating Devices and tuna value chain as the major interventions. The results on Data Buoys as FADs showed that increase in tuna catch was 65 %. As much as 90% fishers demanded deployment of more DBs. Similarly regarding tuna value chain, 'maas' production turn over was Rs 10 to 11 crores and at current price of 'maas' (Rs 175 /- per kg) selling to Tuna Canning Factory (TCF) is less profitable. As much as 92 % fishers demand increase in procurement price.

Sponsored Projects

FUNDING AGENCY	**ICAR AP Cess Fund**
PROJECT TITLE	**Economic evaluation of trawl fishing in Andhra Pradesh and Kerala**
SCIENTISTS	**R. Narayanakumar** and R. Sathiadhas
CENTRES	Visakhapatnam and Cochin

Factor productivity analysis has been undertaken for the input- output data collected from the trawlers of AP and Kerala. Both labour and capital productivity of these units show postitve signal indicating further expansion of trawl units in Indian Coast concentrating much deeper areas. Some of the highlights are :

- In Kakinada zone of Andhra Pradesh, the capital productivity was higher in January-June (0.24) than in July-September (0.47). The labour productivity in singleday fishing was high during July-September (72kg/labour/trip) than during January-June (43kg/labour/trip).
- In multi-day fishing of 2-5 days duration in Andhra Pradesh, the capital resource use was efficient in Kakinada with a lower operating ratio of 0.42 against 0.58 at Bhairavapalem. In terms of labour productivity also, the units operating from Kakinada recorded 204 kg per crew per trip as compared to 100 kg at Bhairavapalem. In Kerala, the operating ratio was comparatively high than in AP, which

ranged from 0.68 at Munambam Fisheries Harbour to 0.76 at Cochin Fisheries Harbour (CFH). However, the labour productivity in Kerala was higher than that in Andhra Pradesh, which ranged from 150 kg per crew per trip at CFH to 330 kg per crew per trip at Beypore (Calicut).

- For the multi-day fishing of 5-10 days duration, the capital productivity was efficient in Andhra Pradesh with lower operating ratios of 0.33 and 0.63 at Kakinada and Bhairavapalem against 0.74 at Munambum Fisheries Harbour, 0.69 at Sakthikulangara, 0.73 at CFH and 0.55 at Beypore in Kerala. Here also the labour productivity was higher in Kerala, which worked out to 180kg per crew per trip at CFH, 278kg at Munambum, 297kg at Sakthikulangara and 477kg at Beypore, when compared with 400 kg at Kakinada and 129kg at Bhairavapalem in Andhra Pradesh.

Multiday trawlers

FUNDING AGENCY	**ICAR Network Project**
PROJECT TITLE	**Impact Assessment of fisheries research in India**
SCIENTIST	**C.Ramachandran**
CENTRE	Cochin

- The methodology to be adopted for the project was discussed at the two day workshop on "Methods of Impact assessment" organized at CMFRI during 3-4 July 2006. The methodological peculiarities of TFP in the case of capture fisheries were highlighted and finalization of a standardized methodology was deferred in the case of capture fisheries. As per the instructions of the workshop mussel culture technology was identified as the candidate technology under culture fisheries and marine fisheries management was tentatively identified under capture fisheries.
- The data collection tools for culture fisheries have been developed after conducting a pre-testing exercise in two Panchayats located adjacent to the Korappuzha estuary in Kozhikode. Preliminary investigations done at the Korappuzha estuary indicate that though the diffusion of mussel farming technology registered four times increase compared to the early adoption stage in 1999-2000, the technology now seem to face problems of overadoption resulting in disenchantment by 20 % of the early adopters. This is attributed to not only the negative externalities of the technology which compete with the livelihood interests of the stake net fishers who allege that the mussel farming has caused depletion in their catch but also the very high increase (300%) in the cost of the seed. At Dalavapuram, Kollam which is considered as the epicenter of oyster farming, the mussel farming technology (which was introduced in 2004) has been poised for an adoption leap as 32 women SHGs have ventured into mussel farming this year.
- To supplement the econometric methods of impact assessment protocols for qualitative indices like research trajectories were developed. The Journal of Marine Biological Association of India volumes 1-35 was subjected to content analysis on a 15 point typology encased in three epistemological categories. To decipher the comparative position in research areas selected volumes of the Journal of Marine Biological Association of UK was also subjected to the same analysis.

Mussel farming - an emerging enterprise of SHGs of Dhalavapuram

Fish ready for transportation

FUNDING AGENCY	**Marine Products Export Development Authority**
PROJECT TITLE	**Participatory management and conservation of lobster resources along the Indian coast**
SCIENTISTS	**E.V. Radhakrishnan,** B. Meenakumari and Pravin Puthran (CIFT)
CENTRE	Cochin

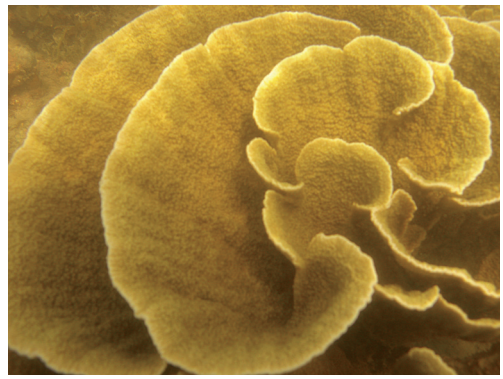
The Honourable Fisheries Minister, Tamilnadu, Sri. K.P.P.Samy releasing a lobster conservation poster at a Workshop held at Chennai

- CMFRI, CIFT and MPEDA jointly organized a one day workshop on 'Participatory management and conservation of lobster resources along the Indian coast' at Export Fish landing Centre, Kasimedu Chennai on 6 March 2007, which was inaugurated by Sri K.P.P. Samy, Honourable Minister for Fisheries, Tamilnadu. The workshop was presided over by Prof. (Dr.) Mohan Joseph Modayil, Director, CMFRI. Dr. S. Kannaiyan, Chairman, National Biodiversity Authority of India gave a keynote address. About 300 participants including fishermen association, traders, exporters, NGOs, Government Agencies, research institutes and students from Fisheries College attended the workshop.
- Establishment of Regional Fishery Management Councils were suggested for management of the fishery through participatory approach. Fishermen also took pledge that they will abide by the conservation measures implemented by the respective panchayats following the guidelines given by scientists.
- The videofilm on lobster conservation in five languages (English, Hindi, Tamil, Gujarati and Marathi) has been completed.
- Posters, pamphlets and stickers in Tamil were distributed to fishermen of 30 major lobster fishing villages in Tamilnadu.
- Two display boards of the Notification issued by Ministry of Commerce and Industry, Government of India on Minimum Legal Size for export of lobsters were fixed at two lobster fishing villages, Chinnamuttom and Khadiyapatnam in Kanyakumari district.

Marine Biodiversity

PROJECT CODE	**MBD/01**
PROJECT TITLE	**Studies on the coral biodiversity of Gulf of Mannar Biosphere Reserve**
SCIENTISTS	**Rani Mary George,** T.S. Naomi, N.K. Sanil, Sandhya Sukumaran, K.K. Joshi and Molly Varghese
CENTRES	Mandapam Camp, Tuticorin and Cochin

- Seventy five species of hard corals were collected from reefs around 12 islands of Gulf of Mannar and 2 reefs of Palk Bay during study period. The reefs around the islands such as Shingle, Krusadai, Pullivasal, Poomarichan, Manauli, Hare, Valai, Talayari, Mulli, Appa, Anaipar and Valimunai were surveyed and studied inorder to assess the present status of coral cover and biodiversity.
- Resource surveys were conducted following Line Intercept Transect method in Gulf of Mannar Biosphere Reserve (GOMBR) to collect information on the present status of coral cover and biodiversity.
- A total of 6 islands: Shingle, Krusadai, Pullivasal, Manauli, Manauliputti, and Nallathani islands were surveyed and underwater photographs were taken to assess their present status.
- Eighty species collected from 12 islands of GOMBR and 2 reefs of Palk Bay were identified, confirmed, documented and GIS based database developed. Among these, *Montipora digitata* was the dominant in the reefs. A systematic appraisal of hard coral (Family Acroporidae) from the Gulf of Mannar Biosphere Reserve has been prepared. This deals with 43 species of the family Acroporidae belonging to 2 genera. Among the species under the 2 genera, four species are new to India and four new to science.
- The reefs spread around Manauli were the richest in Shannon diversity index with a value of 2.97.
- A survey of the islands in GOMBR as well as from the landing centres revealed ten species of gorgonids viz., *Thesea flava, Leptogorgia australiensis, Echinogorgia reticulate, E. complexa, Juncella juncea, Echinomuricia indica, Subergorgia suberosa, S. reticulate, Heterogorgia flabellum* and *Gorgonella umbraculam.*
- Ten species of soft corals were identified, confirmed and documented as *Sinularia jasminae, S. parulekari, S. kavarattiensis, S. gaveshaniae, S. brassica, Sarcophyton elegans, S. cherbonnieri, Lobophytum pauciflorum, Cladiella laciniosa* and *Xenia* sp. Of these, *Sarcophyton elegans, Sinularia brassica* and *Lobophytum pauciflorum* have been reported from the islands of GOMBR earlier, while the remaining 7 species, *Sinularia jasminae, S. parulekari, S. kavarattiensis, S. gaveshaniae, S. cherbonnieri, Cladiella laciniosa* and *Xenia* sp. are reported from Gulf of Mannar Marine Biosphere Reserve for the first time. The occurrence of *Xenia* sp. is new to Indian waters. GIS based systematic database of the 10 species of soft corals was also developed.



Montipora foliosa

Lobophytum pauciflorum

Lobophytum pauciflorum sclerites

PROJECT CODE	**MBD/ 02**
PROJECT TITLE	**Species diversity of exploited marine finfish resources along the Indian coasts**
SCIENTISTS	**Miriam Paul Sreeram,** V.S. Kakati, Rani Mary George, T.S. Naomi, N.K. Sanil, S. Jasmine, Molly Varghese, K.K. Joshi, Sandhya Sukumaran, Rekha J. Nair and Sujitha Thomas
CENTRES	Mumbai, Mangalore, Karwar, Cochin, Mandapam Camp and Tuticorin

Pristigenys niphonia Japanese big eye -a new record from the Indian waters

- Inventorisation of the species diversity in fishery was continued at Mumbai, Karwar, Mangalore, Kochi, Vizhinjam, Mandapam and Tuticorin up to December 2006. A total of 654 species of finfishes belonging to 134 families were recorded from commercial landings. Of these 63 species were elasmobranchs belonging to 16 families.
- Carangids was the most diverse family with 47 species followed by serranids (34 species), lutjanids (25 species), clupeids (19 species), sciaenids (19 species) and engraulids (19 species)
- 9 new records of finfishes have been made from Kochi viz., *Canthidermis macrolepis*, *Satyrichthys hians*, *Hirundichthys rondeletii*, *Chlorophthalmus acutifrons*, *Cepola macrophthalma*, *Neoscopelus macrolepidotus*, *Xanthichthys lineopunctatus*, *Amphichthys cryptocentrus*, *Lutjanus coeruleolineatus.* One new record (*Sacura boulengeri*) for India has been reported from Mumbai. *Sacura maragaritacea* and *Pseudanthias fasciatus* are two new records for India reported from Neendakara.
- The giant guitarfish *Rhynchobatus djiddensis*, which is protected under Schedule I (Part II) of the Wildlife (Protection) Act, 1973 is being landed in commercial quantities by trawl and hooks and lines at Mumbai. Landings for 2006 were 158 tonnes.

PROJECT CODE	**MBD/ 03**
PROJECT TITLE	**Studies on the specific and intraspecific diversity of carangids of the Indian seas**
SCIENTISTS	**K.K. Joshi,** Rekha J. Nair, Miriam Paul Sreeram, Sujitha Thomas, V.S. Kakati, S. Jasmine and Sandhya Sukumaran
CENTRES	Tuticorin, Kochi, Mangalore, Karwar, Mumbai and Mandapam

- At Tuticorin, 25 species of carangids were collected, identified and morphometeric and meristic measurements taken. Juveniles and adult fishes of *Carangoides armatus*, *Carangoides ferdau*, *Caranx sexfasciatus*, *Gnathanodon speciosus* and *Trachinotus blochii* showed wide variation incolour, body shape and fin structure.
- Forty-five species of carangids under 15 genera of the family Carangidae were identified photographed and the meristic and morphometric characters documented for the final preparation of an illustrated taxonomy manual for the Carangidae family from the Indian seas.

Carangid diversity of Indian coast

Genera	Species	Genera	Species	Genera	Species
Alectis	2	*Atropus*	1	*Carangoides*	8
Atule	1	*Caranx*	8	*Gnathanodon*	1
Decapterus	3	*Elagatis*	1	*Megalaspis*	1
Naucrates	1	*Parastromateus*	1	*Scomberoides*	4
Alepes	2	*Trachinotus*	4	*Selaroides*	1
Selar	1	*Seriola*	1	*Seriolina*	1
Uraspis	3				

- Maximum species diversity was from the Cochin area followed by Tuticorin.
- *Carangoides bajad* a new record is reported from the Indian coast.

Mariculture

PROJECT CODE	**MD/CUL/01**
PROJECT TITLE	**Seed production for shellfish mariculture**
SCIENTISTS	**K. R. Manmadhan Nair,** E. V. Radhakrishnan, P. Muthiah, S. Dharmaraj, V. Kripa, G. Maheswarudu, K.K. Philippose, Josileen Jose, I. Jagadis, M.K. Anil, Shoji Joseph and Joe K. Kizhakudan
CENTRES	Mandapam Camp, Calicut, Cochin., Tuticorin, Visakhapanam, Vizhinjam and Chennai

- 7.1 million post larvae of *P. semisulcatus* with an average survival rate of 48.3% was produced in the hatchery.
- Larvae of *P. sanguinolentus* reared to settlement for the first time.
- 53,500 *P.pelagicus* seeds produced with an average survival of 0.06 to 17.3%.
- Hatchery produced seeds of *P.semisulcatus* and *P.pelagicus* were transported from Mandapam to Calicut. Average survival of shrimp postlarvae at a stocking density of 2040 nos/l was 73% and in baby crabs, 51% survival was obtained at a stocking density of 160 nos/l.
- The phyllosma larvae of *P.homarus* attained stage VIII in 42 days on an exclusive diet of *Artemia*, shortening the larval period. Earlier stage VI larvae were obtained in 60 days. This was achieved by feeding PUFA-enriched and *Nannochloropsis salina* enriched *Artemia* of different sizes. 6-8 hr enrichment was adequate for optimum enrichment.
- *N. salina* yielded *Artemia* nauplii with considerable eicosapentaenoic acid (8.05%), arachidonic acid (14.15%) and docosahexaenoic acid (1.85%) after 8 hr of enrichment.
- *Petrarchus rugosus* seeds were produced in hatchery with 8% survival.
- 60,000 spats of *Pinctada fucata* were produced in hatchery and transferred to farm. 15,000 juveniles recovered are being reared further.
- Egg capsule of *S. pharaonis* collected from FADs was hatched out. F_1 generation matured and spawned with in 191 days. F_2 generation hatchlings reared to juveniles measuring 22-24 hrs mantle length in 30 days. Survival ranged from 78 to 86%.
- Pediveliger larvae of *P. malabarica* and *P. fucata* were transported from Tuticorin to Calicut.
- Remote set spat of *P. malabarica* and *P. fucata* show higher growth rate in Ashtamudi lake. Upflow system gave higher growth rate in *Meritrix casta* in comparison to natural growth.

PROJECT CODE	**MD/CUL/02**
PROJECT TITLE	**Development of diversified and sustained mariculture grow-out systems**
SCIENTISTS	**V. Kripa,** K.S.Mohamed, K. R. Manmadhan Nair, K.P.Said Koya, P.Laxmilatha, Geetha Sashikumar, Gulshad Mohamed, P. K. Asokan, P. Vijayagopal, P. Muthiah, T. S. Velayudhan, I. Jagadis, G.Syda Rao and Joe Kizhakudan
CENTRES	Cochin, Minicoy, Calicut, Mangalore, Veraval, Mandapam Camp, Tuticorin, Chennai and Vishakapatnam

A farmer feeding chopped fish and rice to the stocked fishes

A close-up of the fish- pen farm with opening for feeding

The walk-way in the integrated mariculture farm at Calicut

INTEGRATED FARMING SYSTEMS

- Integrated farm facilities for bivalve farming (on-bottom and off-bottom) and finfish farming (cages and pens) was developed at Moorad, Calicut.
- Cages of two different materials were prepared and moored at Moorad estuary along with the bivalve farm structure.
- Three pen structures were also erected, which were made using split bamboo screens by the fishers themselves. The pens were covered on top to prevent predation by birds.
- The cages were stocked with undersized fishes (*Etroplus suratensis* and *Lutjanus* spp) which were caught by the fishers in their fish traps. For *E. suratensis*, boiled rice was provided as feed and for snappers, chopped low cost fish meat and dried clam meat were given as feed. The *E.suratensis* grew from 10 to 30 gram to 165 to 230 gms while the snappers reached 350 to 410 gm in two months. The experiment was carried out with the active involvement of fishermen families

MUSSEL FARMING

- The production, quantity and the area farmed (during 2005-06) through off-bottom and on-bottom methods in all the districts of Kerala was estimated through a planned survey and by visiting the commercial farms.
- Mussels were farmed following rack (off-bottom) method in the estuaries and backwaters of Kasargod, Kozhikode, Malappuram, Thrissur, Ernakulam and Kollam districts of Kerala during the period 2005-06 and this has contributed to 81% (8140 t) of the total farmed mussel production of 10060 t during the period 2005-06 (Table). On-bottom farming, which is simple re-laying of seed mussels with low inputs, is mainly invogue in Kannur, Malappuram, Kozhikode and Kollam districts and has contributed to 19% (1920 t) of the production. The value of the mussel produced is estimated as Rs.80.6 million during the period 2005-06.
- The average productivity for rack method was estimated as 565 t/ha while for on-bottom method it was 172 t/ha. However, there was regional difference in productivity, with high values in Kasargod.
- The socio-economic impact of mussel farming in three districts of North Kerala was studied.
- Three types of ownerships were observed for mussel farms *viz*., individual ownership , family ownership and ownerships by Self-Help Groups. At Kasargod, maximum number of farmers (67%) were

Details of the farmed mussel production, area used for farming and productivity of mussel farms during 2005-06

District	Production (t)			Area (in ha)			Productivity (t/ha)	
	Rack	On-bottom	Total	Rack	On-bottom	Total	Rack	On-bottom
Kasargod	7496	0	7496	12.14	0.00	12.14	617.5	
Kozhikode	211	511	722	0.82	3.11	3.93	257.1	164.3
Kannur	0	825	825	0.00	4.58	4.58		180.1
Malappuram	399	558	957	1.40	3.30	4.70	285.7	169.1
Thrissur	5	0	5	0.01	0.00	0.01	617.3	
Ernakulam	25	0	25	0.04	0.00	0.04	617.3	
Kollam	4	26	30	0.01	0.18	0.19	615.4	143.6
TOTAL	8140	1920	10060	14.41	11.17	25.58		

motivated by the successful mussel farming activities in the neighbourhood and 30% of the farms were set up due to demonstration. In Kozhikode and Malapuram, 88 and 66% of the farmers respectively were motivated by the training programme of CMFRI.

- Farming activities were supported by local financial institutions. The Internal Rate of Return for mussel farming at Kasargod, Kozhikode and Malappuram were 190, 230 and 350, respectively.
- There was no significant variation in production when seeded at 2, 2.4 and 2.8 kg/m of rope.

PEARL CULTURE

- Organ and explant cultures were done in other pearl producing molluscs like *Pteria* sp. and *Pinna* sp. Good cells were released from explant cultures and pearl sacs and crystals were developed from the organ cultures. These results proved that *in-vitro* pearls can be produced from other pearl producing molluscs also.
- Three different species of pearl oysters viz. *Pinctada fucata*, *P.margaritifera* and *P.sugillata* were grown in the rafts moored at Lakshadweep. Growth rate of *P.margaratifera* varied from 0.6 mm to 3.99 mm month^{-1}. The growth rate for both *P.fucata* and *P.sugillata* was a maximum of 3.12 mm in February.
- Tuticorin pearl oyster farm was stocked with 60,000 hatchery produced spat, and of these 15,000 became implantable size (above 45 mm). However, heavy mortality (75%) due to fouling by bryzoans took place in December 2006. Apart from these oysters the farm was also stocked with 300 pearl oysters collected from the Punnakayal.
- The work on onshore pearl culture was continued at Vishakapatnam. *P. maxima* and *P. margaritifera* were fed with a mixed diet of *Chaetoceros calcitrans*, *Isochrysis galbana* and *Nannochloropsis* spp. In one year the oysters had grown 80 to120 mm. The regenerated saibo of *P. fucata* produced good quality pearls.

OYSTER FARMING

- In an experiment for the production of cultch-less spat and single oyster culture in north Kerala, lime coated shells of *M. casta* of length 25 mm and 15mm and broken shells pieces of green mussels

Fattened lobsters in black coloured tanks

Fattened lobsters in light coloured tanks

The shrimp raceway at Mandapam

were placed in 0.5m^2 netlon cages. It was observed that maximum settlement was on 25 mm lime coated shells. The oysters grew to an average length of 62 mm with 8% meat. The average mortality was 51%.

- *C. gryphoides* farming was done at Navibunder Gujarat. The intensity of spatfall was 4 o 8 per shell. In five months, the oysters reached harvestable size.

CLAM FARMING

- Experiments for development of techniques for clam farming were conducted at Ashtamudi Lake, Kollam, Kerala. Three treatments based on stocking densities of 1000, 2000 and 3000/m^2 were adopted in triplicate. After cleaning the area to be sowed of all debris, a clam tent made of PVC coated wire mesh [1 cm] was placed over the clam seeds (*Paphia malabarica*). Results showed that a stocking density of 2000 nos/m^2 is better than 3000 and 1000 nos/m^2 in terms of low mortality and high weight gain during the first 23 days of culture. Those clams sowed without clam tents showed complete mortality within 23 days of farming.
- At Tuticorin, the seed of *P. malabarica* of 9.3 mm length were reared from July'05 in cages suspended from the racks (off-bottom method). After 10 months the mean size was 32.1 mm with a survival of 13%.

LOBSTER FARMING

- Experiments using different tank colours, substrates, hideouts and filters showed black coloured tanks, restricted light exposure (22 D : 2 L) using black nylon screens as tank covers and external biofilters of one-third capacity of the rearing system with nearly 70 – 100 cm high water column gave better colouration in lobsters.
- Trimming antennae was found to greatly reduce the territorial defense and aggressive behavior among the lobster, leading to reduced cannibalism, improved growth rates and better performance under high density stocking (3 – 5 kg sq.m^{-1}).
- Alima larvae collected simultaneously with puerulii of the spiny lobster *P. homarus* during the period Feb-March 2006 were reared in the laboratory at Kovalam. Metamorphosis of alima into juvenile squilla and of puerulii into post-puerulii was synchronous and the post-puerulii were found to be highly receptive to young squilla as feed.
- The use of squilla meat was found to increase moult frequency in the post-puerulii and early juveniles of *P. homarus*. Average daily increment was 0.49 g for male and 0.45 g for female.
- Hatchery–raised seed of the sand lobster *T. orientalis* was grown in captivity to adulthood. The seed attained adulthood after rearing 8 – 10 months (150 - 170 g size).
- Raceway culture of green tiger shrimp *Penaeus semisulcatus* was carried out on an experimental basis for the first time. Cement tank of 20 x 5 x 2 m was stocked at 170 nos m^{-2} and a total of 27,235 PL were stocked. Daily replenishment water was 30 to 50%. The average size at harvest was 90 mm total length and 6.9 g weight. From this

harvest 7159 nos (49.4 Kg) were restocked in the same tank at a reduced stocking density of 44.7 nos m^{-2} and reared till 180 days and harvested. The survival in the second stage of culture was 77.7% and quantity harvested was 84.5 Kg. Average production was 0.35 kg/m^2.

A view of the harvested shrimp from raceway

SEAWEED FARMING

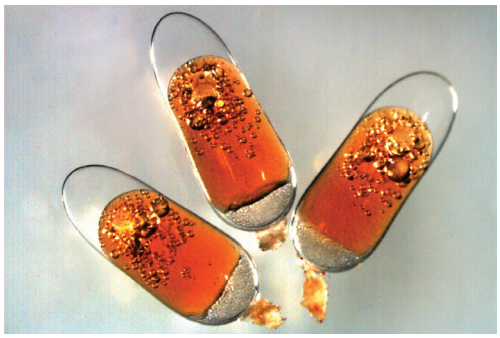
- Pilot scale field cultivation of the carageenan yielding red seaweed *Kappaphycus alvarezii* was carried out by vegetative propagation method using bamboo rafts (3.5 x 2.5m size) in Palk Bay near CMFRI fish farm. A total of 98 bamboo rafts with *K. alvarezii* seed material were introduced. The total quantity of seed material introduced was 2.5 tons. A total of 6.6 tons (wet wt) of crop was harvested after 4 months. Nearly seven fold increase was obtained during July-September.
- Onshore culture of *K. alvarezii* was carried out in 68 ton cement tank. In the tank 4842 baby crabs of *P. pelagicus* and 8 kg of *K. alvarezii* were stocked. Half of the water (50%) was exchanged daily and aerated for 24 hours. After a growth period of 30 days the biomass of the plant showed two-fold increase in weight.
- Pilot Farming of *K. alvarezii* was carried out in the sea off Narakkal. The culture period was for 90 days when a total of 214.8 kg were harvested from 716 net bags from two rafts. The dry weight ranged from 9-10 % after 60 days of culture period.
- Carrageenan was extracted from the seaweed *Kappaphycus* from 10-90 days at an interval of 15days cultivated at Cochin. Maximum yield of 39.8% was obtained on 45 days of culture period.
- A maximum of eleven fold increase in yield of *K. alvarezii* in 59 days by adopting fixed bottom nylon rope method and maximum of seven fold in 31 days for raft culture was obtained at Thikkodi, Calicut district.
- At Navibunder in Gujarat *K. alvarezii* was cultured on nylon ropes using the loop method. 100 g of seed attained 1.5 kg in 45 days.

Harvestable crop of *Kappaphycus alvarezii*

PROJECT CODE	**MD/CUL/03**
PROJECT TITLE	**Broodstock development and seed production for finfish mariculture**
SCIENTISTS	**G. Gopakumar,** Grace Mathew, L. Krishnan, D. Noble, K. Madhu, Rema Madhu and Boby Ignatius
CENTRES	Mandapam Camp, Vizhinjam and Cochin

- Spawning and successful larval rearing of the rabbitfish *Siganus canaliculatus* were achieved for the first time. The average length of the larva on day 2 was 2.87mm with mouth gape of 100-125µ. Larval rearing was done in the green water produced by the microalga *Nannochloropsis* sp. Rotifers were fed at a density of 5 to 10 nos/ml. Between 20 to 25 days of post hatch, the larvae metamorphosed into juvenile fishes.
- Seed production methods of the humbug damsel *Dascyllus aruanus*, three spot damsel *Dascyllus trimaculatus* and the blue damsel *Pomacentrus caeruleus* were standardised and several batches were hatchery produced and marketed for income generation.

Broodstock of *Premnas biaculeatus* incubating the eggs



Eggs of *Premnas biaculeatus*

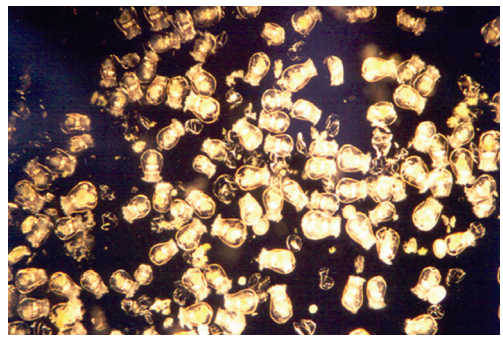
Hatchery produced juveniles

- Broodstock development and larval rearing of the blue green damsel *Chromis viridis* was achieved for the first time. The fishes became broodstock at a total length range of 8 -9 cm. The average frequency of spawning was 5 per month with an interval of about 5 days. The average length of newly hatched larva was 2.25mm. The larvae were fed on copepod nauplii. After 20th day, the larvae were also fed *ad libitum* with freshly hatched *Artemia* nauplii. The larvae started metamorphosing from 32nd day and upto 49th day.
- Captive breeding and spawning of spine-cheek anemone fish *Premnas biaculeatus* were accomplished for the first time in India. The standard length of the female varied between 120 to 140 mm (presumptive female) and that of male varied between 55 to 60 mm (presumptive male).
- An average 2 spawnings per month per pair were obtained. The newly hatched larvae measured 2.5 to 3.6 mm in total length. Enriched rotifers were provided as live feed for larviculture.
- One pair of *A. percula* in F_1 generation successfully spawned; 85 - 95 % of larvae survived and 800 juveniles of F_2 generation were produced.
- 5000 numbers of seeds of *A. ocellaris* and 4500 seeds of A. *percula* were produced and marketed for income generation.
- Broodstock development of two species of groupers *Epinephelus malabaricus* and *E. polyphekadion* was continued. Eleven numbers of broodstock of *E.malabaricus* ranging in weight from 2.8 kg to 5.8 kg were developed for breeding and seed production.

PROJECT CODE	**MD/CUL/04**
PROJECT TITLE	**Mass culture of live feeds and nutritional enrichment for larviculture**
SCIENTISTS	**G. Gopakumar,** Reeta Jayasankar, Josileen Jose, Gulshad Mohammed, Boby Ignatius, Shoji Joseph, Joe K. Kizhakudan, P. Vijayagopal and Molly Varghese
CENTRES	Mandapam Camp, Calicut, Cochin and Chennai

- Experiments on mass culture of the calanoid copepod *P.serricaudatus* were conducted. *Nannochloropsis* was used as feed
- Experiments were conducted on mixed culture of the two species selected *viz. P.serricaudatus* and *E.acutifrons*. The methodology was same as that employed for the culture of *P.serricaudatus.*
- Co-culturing of copepods in green water in the larviculture tank is the most effective larval rearing protocol for marine finfishes. The adult copepods of *E. acutifrons* and *P serricaudatus* were introduced into the tanks after maintaining *Nannochlorpsis* culture.
- Experiments on the larviculture of five species of ornamental fishes *viz*; *D. trimaculatus*, *D. aruanus*, *P. ceruleus*, *Neopomacentrus nemurus* and *C. viridis* were conducted by this method.
- In *D.aruanus* the number of copepods and copepodites /50 ml in the first phase of larviculture was from 2 and 273, respectively.
- In *D.trimaculatus* the number of copepods and copepodites /50 ml in the first phase of larviculture was 22 and 203, respectively.

- In *P. caeruleus* the number of copepods and copepodites /50 ml in the first phase of larviculture was 7 and 263, respectively.
- In *N. nemurus* the number of copepods and copepodites /50 ml in the first phase of larviculture was 2 and 262, respectively.
- In *C. viridis* the number of copepods, nauplii and copepodites /50 ml in the first phase of larviculture was 5 and 116, respectively.
- Rotifer enriched with *Chlorella salina* and *N. oculata* gave 45-68% larval survival in the clown fish *A. perucla*.
- Feeding the clownfish *A. percula* larvae with rotifer in green water containing *N. occulata* and *C. salina* showed 90% survival upto 3rd day of post hatch.
- Use of *C. salina* and *N. oculata* as green water immediately after hatching to 3rd day of post hatch gave 50-70 % survival in *A.percula*
- New strains of microalgae like *Chlorococcus*, *Anabaena*, marine *Spirulina*, *Chaetoceros*, *Nannochloropsis* and *Synecococcus* were isolated and maintained.
- Experiments on the effect of microalgae on first feeding of blue damsel showed that feeding intensity was more in green water system produced by *Nannochloropsis*. Ammonia concentration was found to be the limiting factor in rotifer cultures.
- Feeding experiments showed raw sardine oil suspension produced good results when fed to *P. rugosus* phyllosoma, while feed reception was poor with cod liver oil. A combination of spirulina and cod liver oil proved to be good for spiny lobster *P. homarus* phyllosoma (stages I and II).



Codliver oil enriched rotifers

Sponsored Projects

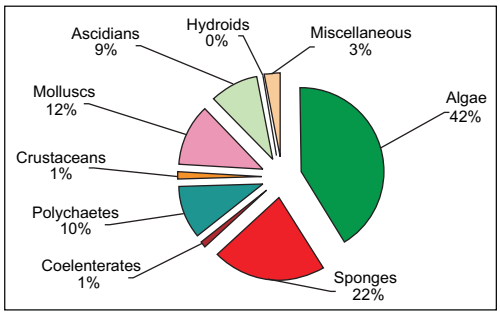
FUNDING AGENCY	**Ministry of Earth Sciences**
PROJECT TITLE	**Farming and pearl production in the Blacklip pearl oyster**
SCIENTISTS	**M. J. Modayil,** K.S. Mohamed, T.S. Velayudhan and V. Kripa
CENTRE	Portblair

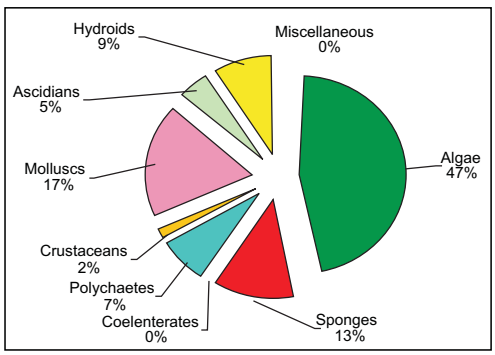
- Seawater intake (two 5 HP centrifugal pumps) from 5 m depth with 20 tonne storage and downstream filtration using pressure sand filter and 10-0.3 micron serial cartridge filters for supply of high quality seawater to hatchery were installed. A 2 million spat/year mini pearl oyster hatchery with all necessary FRP tanks and air-lines was established.
- Designed and deployed a large 15x8 m wooden raft in Havelock Island with stay-in facility and laboratory space for conducting surgical implantation of pearl oysters.
- Individual wire mesh cages were fabricated for exclusively holding operated and convalescing oysters.
- Mabe pearl technology standardized in *Pinctada margaritifera* and *Pteria penguin* including the narcotization and adhesion methodologies. New designs of images were made locally and a

Large 15x8 m wooden raft in Havelock Island with stay-in facility and laboratory space for conducting surgical implantation

design for converting mabe-on-shell to a decorative table souvenir was finalised in consultation with local shell-craftsmen.

- Thirteen numbers of *Pteria penguin* and 4 nos of *P. margaritifera* implanted with half nucleus, by a novel method by which a rectangular piece of shell is cut from the right valve of the oyster, adjacent to the byssal thread area; a half pearl nucleus is stuck to the inner side of the shell piece using 'Feviquick' and placed back. A corresponding piece of shell cut from another oyster was placed over the cut portion and sealed using 'Fevikwik' and shell powder.
- The biometric relationships between (Dorso-Ventral measurement [DVM] and Hinge Length [HL]; Thickness [THK] and Total Weight [TWT]) were studied from 458 oysters collected from these islands which were grouped in 5 length classes. In all size groups, there was increase in weight with increase in length. The highest coefficient (r^2=0.7828) was obtained for the animals with DVM ranging from 76 to 95 mm. The correlation coefficient 'r' was low for DVM-HL and was slightly higher for DVM-THK. Comparisons of biometric relationships of the natural populations of the Indian pearl oysters with that of farmed oysters in other regions indicated xenomorphism due to constricted space in natural habitats on the shape of pearl oysters in Andaman and Nicobar Islands





Comparison between relative prevalence of fouling organisms on pearl oysters (A) and pearl oyster cages (B) at Havelock Island pearl farm, Port Blair

Intercept (a), slope (b) parameters and correlation coefficient (R^2) for the relationships between DVM and TWT in different size groups of *Pinctada margaritifera*

Size group (mm)	N	'a' value	'b' value	R^2 value
36-55	22	0.1381	2.9872	0.6514
56-75	126	0.0670	3.3894	0.7142
76-95	198	0.0157	4.0728	0.7828
95-115	84	0.1679	2.9723	0.6216
116-135	28	0.0295	3.6832	0.6035

FUNDING AGENCY	**Dept. of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India**
PROJECT TITLE	**Open sea floating cage demonstration farm for R&D in marine finfish and shellfish production**
SCIENTISTS CENTRES	**M.J. Modayil,** L. Krishnan, G. Syda Rao, G. Gopakumar, V.V. Singh and P.K. Asokan Mandapam, Visakhapatnam, Ratnagiri and Diu

- Potential mariculture sites along Indian coasts were identified and out of which selected 4 sites viz. Visakhapatnam and Mandapam on the east coast and Ratnagiri and Diu on the west coast. Hydrological and ecological parameters of the sites were evaluated and suitability of the sites established.
- Detailed consultation and desk studies were carried out with teams of leading net and cage frame manufacturing companies and appropriate nets ad cages were designed taking into consideration local conditions and species involved.
- Availability of adequate quantities of seed of wild/hatchery produced cultivable fishes were evaluated and protocols for seed procurement, conditioning, live transport and holding were developed.
- For the first cycle of operation, adequate quantities of seed of the

Floating open sea finfish culture cage launched off Visakhapatanam

commercially valuable species, Seabass (*Lates calcarifer*) were procured from the hatchery of Rajiv Gandhi Centre for Aquaculture, at Sirkali and the seed were air lifted/transported by road to the various destinations (maximum periods upto 34 hours in transit) without any mortality and this is a significant achievement.

- Floating cages were fabricated through outsourcing and launched in the open sea at two centres, Visakhapatnam and Diu during the period under review. In other centres, cages will be launched soon after the weather conditions improve.
- Fingerlings of Seabass were stocked at various densities ranging from 2500 numbers at Diu to 8500 at Visakhapatnam.
- The fingerlings in the cages were fed twice a day at a rate of 10-12% there biomass with trash fish.
- Growth rate and survival of the stocked fingerlings are being monitored.

FUNDING AGENCY	**ICAR AP Cess Fund**
PROJECT TITLE	**Technology upgradation in edible oyster farming through development of remote setting and floating upwellar techniques**
SCIENTIST	**V. Kripa**
CENTRE	Calicut

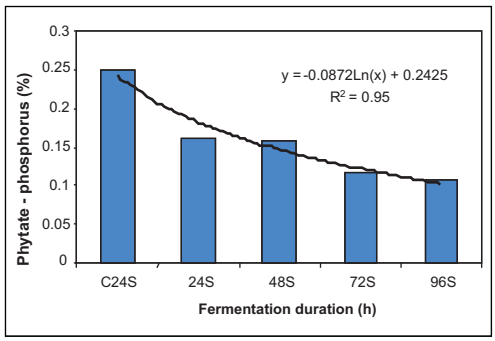
- The growth of the remote set oyster spat at Vallikunnu farm in north Kerala and in the farm at Sattar Island in central Kerala was studied by monitoring the growth during the harvest. The remote set oyster stocked at Sattar Island grew from an average length of 16.06 ± 2.8 mm to an average length of 65.15 ± 6.0 mm in 234 days. The growth of the same stock at Vallikunnu was high, increasing from 13 ± 2.896 mm in October to 87.35 7.74 in June.
- The natural spat fall continued from December to March and the growth of these oysters was monitored separately. At Sattar Island, the oyster spat set in December and January grew from 11.47 ± 4.66 mm and 22.4 ± 7.5 mm, respectively to 53.44 ± 10.33 mm and 57.4 ± 8.1 mm, respectively. The growth rate of spat settled subsequently was slow.

Physiology
Nutrition
Pathology

PROJECT CODE	**PNP/NUT/01**
PROJECT TITLE	**Development of cost-effective and eco-friendly feeds for cultivable marine crustaceans and finfish by biotechnological interventions**
SCIENTISTS	**R. Paul Raj,** Imelda Joseph, Kajal Chakraborty, P. Vijayagopal, D. Kandasami and Margaret Muthu Rethinam
CENTRES	Cochin, Mandapam Camp and Chennai

Nutrient profile of fermented tuna waste and vegetable discards

- The nutrient profiles of co-fermented tuna waste and vegetable discards were determined for their use in aquafeeds as novel ingredients. Co- fermentation of tuna waste with wheat bran using *Lactobacillus plantarum* (LPFT) resulted in 24% increase in total amino acid content on day 10. Crude protein and NFE levels showed a decrease during the course of fermentation (P>0.05).
- Vegetable wastes were used as substrate for fermentation along with mixed ingredients (soybean flour, wheat flour, groundnut cake and sesame oil cake in the ratio 4:3:2:1) in the ratio of 4: 1. *Aspergillus niger* NCIM 616, @ 2 ´10^7 spores 50 g^{-1} substrate was used for fermentation at 30 ± 1°C.
- The maximum crude protein content during fermentation was recorded on day 13 (CP 33.25±0.05). Significant reductions in crude fat and NFE were observed with 49% reduction in NFE. Methionine showed marked reduction (51%) from the initial value. Amino acid which showed increase during fermentation included tryptophan, lysine, histidine, phenylalanine, valine, isoleucine, threonine, leucine, and arginine.
- *Amphiprion ocellaris* juveniles fed on feeds incorporated with 15% co-fermented tuna waste and fermented oil cake mix with and without beta carotene, showed better nutritional value for fermented tuna waste.
- Solid state fermentation of soybean meal and mixed feed ingredients (soyabean flour, wheat flour, groundnut oil cake and gingelly oilcake in the ratio of 4:3:2:1) for 96 hrs using *Basillus licheniformis*, resulted in 41.13% and 44% reduction in phytate phosphorus content in fermented ingredient mix and fermented soybean meal, respectively.
- Phytase and acid phosphatase enzymes were purified from crude extract of *Bacillus coagulans* using ion exchange chromatography and the activities were found to be 10.02 X 10^6 PU/g and 26.5 X 10^6 PU/g, respectively at pH 5.0 and 37^0C. The K_m values were 208 µmol and 272 µmol for phytase and acid phosphatase with the turnover rate of 483 and 828 nmol/sec. SDS-PAGE of purified phytase and phosphatase revealed their molecular weights to be 56 KDa and 48 KDa, respectively.
- Phytase and phosphatase purified from *B. licheniformis* were mixed in 1:1 proportion. The combination of two enzymes from *B. licheniformis* was found to release 79.24% free phosphate after 24 h of hydrolysis from two different antinutritive factors (phytate and polyphosphate) indicating the synergistic activity of the two enzymes in releasing free orthophosphate.

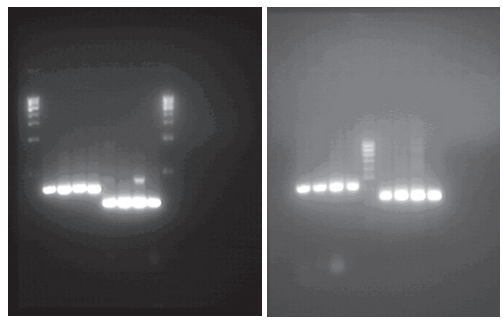


Variation of phytate- phosphorus content in fermented soybean meal

- The highest concentration of EPA from sardine oil (purity 47.78%) was obtained using a higher urea/fatty acid ratio (4:1). EPA has been recovered in high purity (99.6%) with an overall recovery of 41.24%.
- The initial peroxide value (POV) rose to 35.2 mg/kg oil when purification was carried out at relatively higher temperature (6^0C), and declined during subsequent steps of purification.
- Triacylglycerol lipase (triacylglycerol acylhydrolase), an enzyme that hydrolyzes triacylglycerol, was purified from *Pseudomonas fluorescence* by physical methods. The enzyme exhibited optimal activity at pH 7.5. The enzyme was stable between pH ranges of 5.0-8.5 at 35°C for 24 h.
- Female lobsters fed with squilla meat had higher survival rate (86%) and weight gain (116g) compared to males (60% survival) after 7 months of rearing.
- In another experiment when squilla meat was used for rearing juvenile *P. pelagicus*, the male crabs showed relatively better weight gain (33.2 to 123.46%) than the females (39.7 to 94.59%).
- A total of 24 juvenile *P. pelagicus* (4 replicates for each feed treatment) were reared on prepared diets for about 10 weeks and data were collected for weight gain, feed intake, number of moults and FCR. Fresh clam gave faster moulting, growth and FCR. Among the five semi-moist diets, there were no significant differences in weight gain or feed conversion ratios.
- Formulated feed with protein levels ranging from 180 g kg^{-1} to 560 g $kg^{-1}$and energy levels varying between 17 – 19 MJ kg^{-1} were fed to striped damsel, *Dascyllus aruanus* of sizes < 200 mg and 200-300 mg for a period of 35 days and 63 days. The < 200 mg fishes registered maximum growth with the feed containing 380 g kg^{-1} CIM having a protein content of 362 g kg^{-1}. In fishes weighing 200-300 mg, growth was not significantly different (P >0.05) in fishes fed with feeds containing 380 g kg^{-1} CIM and 580 g kg^{-1} CIM with 360 g kg^{-1} and 470 g kg^{-1} protein.

PROJECT CODE	**PNP/BIOT/01**
PROJECT TITLE	**Biotechnological interventions in disease diagnosis and management in mariculture**
SCIENTISTS	**P.C. Thomas,** K.K. Vijayan, A. P. Lipton, K.C. George, K. S. Sobhana, I. Rajendran and Kajal Chakraborty
CENTRE	Cochin

- Biochemical characterization of 18 *Vibrio* isolates collected from diseased rabbit fishes, groupers and lobsters was carried out to the species level. These isolates were identified to be *Vibrio vulnificus* (6), *V. campbelli* (2), *V. fluvialis* (1), *V. alginolyticus* (3), *V. anguillarum* (2) and *V. parahaemolyticus* (4). Ultra-structure study of four field strains of *V. parahaemolyticus* using transmission electron microscope was completed.
- Studies on the prevalence of diseases among the wild stocks of *Crassostrea madrasensis* from Kerala revealed that incidence of rickettsia was 91.5%. Histo-pathological studies of grouper *Epinephelus tauvina* indicated protozoan infection in liver and kidneys.



Amplicons of Vp (387bp & 285bp size) & (410bp & 368bp size) amplified by Vp specific primer pairs 1&2 and 2&3

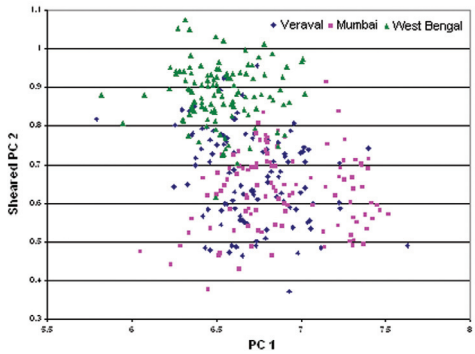
- Pathogenecity evaluation of ten strains of *Vibrio vulnificus* isolated from vibriosis affected grouper by challenge studies (i.p.) revealed that two of the strains were pathogenic at a dose of 10^6 cells/g, causing 100% mortality with in 6 days of challenge.
- PCR trials for the development of molecular diagnostics to detect *Vibrio parahaemolyticus* from mariculture systems using six pairs of oligonucleotide primers revealed that four of them were effective for early detection. Diagnostic reliability was established by screening all the VP isolates using these primers.
- Plasmid DNA profiling of 30 isolates of *V. anguillarum* from the mariculture systems using alkaline lysis method indicated that only 8 isolates carried plasmids ranging in size from 29Kb to 65Kb. The overall prevalence of plasmid was 25.8%.
- The extracellular protein profile of 30 isolates of *Vibrio anguillarum* indicated a total of 10 different proteins in them, of which five were expressed by all the isolates. The POPGENE analysis indicated the number of polymorphic loci to be 12 and percentage polymorphism to be 92.31.
- An indirect plate ELISA test was developed for the immuno-detection of *V. parahaemolyticus* using antiserum raised against its 34 kDa outer membrane protein.
- Primary cell cultures were initiated using kidney, spleen, gill, heart and liver tissues of the groupers, *Epinephelus malabaricus* and *E. tauvina*. The cell culture systems developed are being passaged for developing cell lines of the respective tissues.
- Silica gel column chromatographic purification of the chloroform methanol soluble fractions from *H.musciformis* with antibacterial activity (against *V. parahaemolyticus*) was carried out. Purification of the active fractions yielded methyl 12-methyl tridecanoate and other related analogous. The ethanolic extract of *C. fibrosa* was sub fractionated with different solvents and the fractions were screened for its activity against *Vibrio alginolyticus* (antibacterial) and *Rhizoctonia solani* (anti fungal).Dichloromethane extract exhibited higher activity.

PROJECT CODE **NBFGR-CMFRI/CO1**

PROJECT TITLE **Genetic divergence studies in prioritized marine finfish and shellfish species (Collaborative project with NBFGR)**

SCIENTISTS **P. Jayasankar,** A. Gopalakrishnan (NBFGR) and V. S. Basheer (NBFGR)

CENTRE Cochin



Sheared principal component analysis of truss landmarks of Bombayduck from 3 locations

Bombayduck

- Bombay duck in the length range 165-303 mm were sampled from Versova and Sasoon Dock landing centres of Mumbai (n-119), Nawabunder and Diu centres of Veraval (n=113) and from Kalisthan, Hathipeetiya and Kachuberiya of Kakdip (West Bengal) (n=120).

Sheared Principal Component Analysis (Sheared PCA)

- Principal component analysis of 21 distance measures from 10 landmark points in each fish was carried out. A plot of PC 1 and size-corrected PC 2 indicated clear vertical separation of clusters between the east (represented by West Bengal samples) and west coasts (represented by Veraval and Mumbai samples). This result

shows that Bombay duck populations of east and west coast exhibit marked shape variations, indicating the possible stock differences between the coasts. The clusters of Veraval and Mumbai region were overlapping, indicating the confluence of the populations.

Discriminant function analysis

- Discriminant functions of 21 distance measures from 10 landmarks of samples from the three centres were analyzed using Systat 7.0 and SPSS ver 7.5 and the step-wise discriminant function analysis results were in conformity with those of the sheared PCA

Sequencing of mtDNA 16S rRNA

- MtDNA 16S rRNA of two individuals of Bombay duck each from Mumbai and West Bengal were amplified and sequenced. The number of identical sites was 540 out of 542, number of variable & informative sites 2, transitional pairs 1 and transversional pairs 1. Following is the summary of population genetic parameters: Specific haplotypes, one each specific for Mumbai and West Bengal samples were identified. Pair-wise distance : 0.4%; Nucleotide diversity : 0.25%; Percentage of net substitutions per site : 0.37%; Number of haplotypes: 2 (out of 4 sequences examined); Haplotype diversity: 0.667±0.204;

DNA analysis of lobsters

- Samples of *Panulirus homarus, P. ornatus, P. versicolor, P.longipes P. polyphagus, Petrarchus rugosus* and *Thenus orientalis* were collected from West Bengal, Chennai, southwest coast of India, Mumbai and Veraval. As reported earlier, genomic DNA was successfully extracted from the tip of the antennae, there by obviating either the requirement of buying the entire specimen or sacrificing the live animal for tissue sampling. Morphological identification of the species was confirmed using standard taxonomic keys.

RAPD

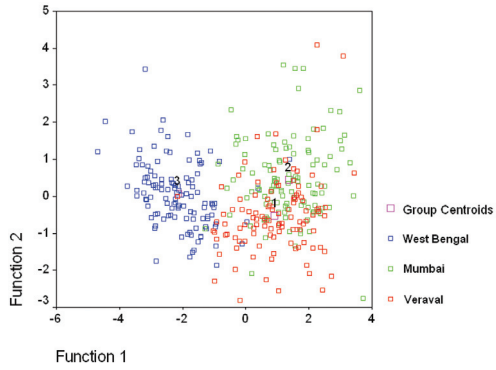
- With a view to developing species-diagnostic markers, cDNA was amplified using arbitrary primers in RAPD. There were perceptible species-diagnostic markers generated by primers OPA 07, OPAA12, OPAC14, OPA08 and OPA10 (Figs. 3a & b).

Microsatellites

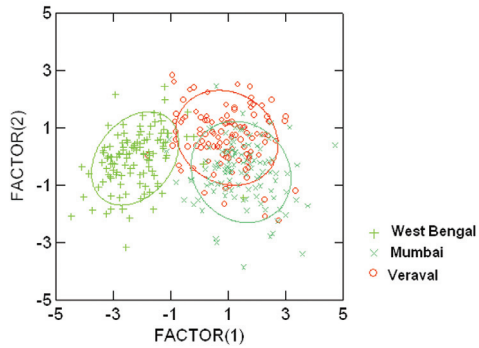
- Primers for 21 polymorphic microsatellite loci were identified from other palinurid species (Diniz *et al.*, 2004; Jones *et al*., 2003) leading to successful amplification by cross-priming and in *P. homarus* and *Thenus orientalis* by slightly altering the primer annealing temperature in the recipient species (7 tri nucleotide repeats; 14 tetra nucleotide repeats). All these 21 polymorphic microsatellite loci generated 4 – 7 alleles in the initial screening and these are now used to score genetic differences in these two species of lobsters.

MtDNA

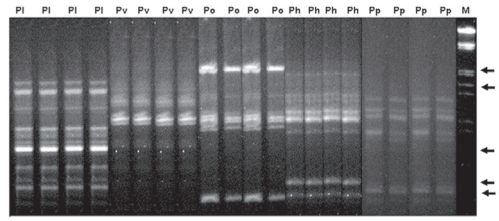
- For partial gene sequencing of 16SrRNA, Cyt b and *COI* genes, sequencing PCR was carried out in *P. homarus, P. ornatus, P. polyphagus, P. versicolor, Petrarchus rugosus* and *Thenus orientalis* using the universal primers and the samples sent for sequencing.



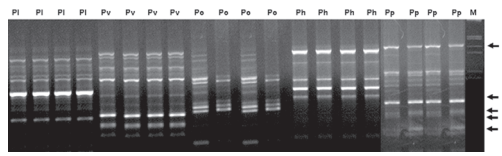
Step-wise discriminant functions along with group centroids of the truss variables of three populations (SPSS ver 7.5)



Step-wise discriminant functions along with group centroids of the truss variables of three populations (Systat ver 7.0)



Species specific RAPD bands generated using primer OPAC14 (Pl, *Panulirus longipes*; Pv, *Panulirus versicolor*, Po;*Panulirus ornatus*; Ph, *Panulirus homarus*; Pp, *Panulirus polyphagus*, M, DNA size marker). Arrows indicate species diagnostic bands.



Species specific RAPD bands generated using primer OPA07 Pl, *Panulirus longipes*; Pv, *Panulirus versicolor*, Po; *Panulirus ornatus*; Ph, *Panulirus homarus*; Pp, *Panulirus polyphagus*, M, DNA size marker). Arrows indicate species diagnostic bands.

Sponsored Projects

FUNDING AGENCY	**Department of Biotechnology, Govt. of India**
PROJECT TITLE	**Development and application of CMG family recombinant hormones, their antagonists and RNAi technique for induced maturation and spawning of *Penaeus monodon***
SCIENTIST	**K.K.Vijayan**
CENTRE	Cochin

- Total RNA isolation from the eyestalk of shrimp was standardized using Guanidium thiocyanate - phenol - chloroform method as per the modified method of Chomczynski and Sacchi, 1987. This method yielded sufficient amount of good quality total RNA for further purification and analysis.
- Two pair of primers for amplifying CDS of GIH gene designed from the conserved region of the sequence of GIH gene of Lobsters and *Metapenaeus* sp. already available in the genbank using Primer 3 software.
- First strand cDNA synthesized from total RNA isolated from the eyestalk tissue using oiligo $dT_{(24)}$ primer.Specific primers designed from the conserved region of the sequence of GIH gene of Lobsters and *Metapenaeus* sp. were used for second strand synthesis. Out of two pair of primers one pair (PMeF / PMeR) produced a ~ 450 bp amplified product as expected.
- The amplified product is in the process of purification and cloning for sequencing .Once the sequencing is completed further works related to the expression studies will be initiated.

FUNDING AGENCY	**ICAR Network project**
PROJECT TITLE	**Investigation on 'loose shell syndrome' among farmed tiger shrimp, *Penaeus monodon***
SCIENTIST	**K.K.Vijayan**
CENTRE	Cochin

- Extensive farm surveys conducted among the shrimp farms of Andhra Pradesh and Tamilnadu during 2006-07 have revealed widespread occurrence of loose shell syndrome (LSS) or the Loose shell disease' (LSD). The LSS was recorded in shrimps weighing between 15-37g, from 45 DOC, in salinities ranging from 30-60 ppt. The affected shrimps were lethargic, spongy / flaccid and had a gap between the muscle and the shell. Affected animals also occasionally showed pinkish discoloration of the branchiostegite, pleopods and lower part of the abdominal segments.
- Farmers occasionally reported that whitening of abdomen (White gut) preceded LSS. Shrimp growth was poor due to anorexia and impaired moulting. Moribund and weak shrimp with muscular dystrophy appeared along the periphery of pond and the mortality progressed in a slow manner. The problem was unnoticed in the beginning with sporadic mortalities.
- LSS affected shrimps showed enlargement of lumen, often containing eosinophilic coccoid bodies of about 3-5mm in size. There was considerable reduction in the number of cells in the stromal matrix surrounding the lumen. Disintegration of connective tissue, resulting in separation of tubules, was also observed in some samples.
- Necrotizing hepatopancreatitis (NHP) in *Litopenaeus vannamei*, which shows similar signs of LSS, was caused by unculturable a-

proteobacteria. All the 13 samples tested produced amplicons of 1500 bp size, indicating its presence. However, the PCR assay carried out using NHP kit of Farming IntelliGene (IQ 2000) kit failed to provide similar results.

FUNDING AGENCY	**NACA-ICAR International Project**
PROJECT TITLE	**Application of PCR for improved shrimp health management in the Asian region**
SCIENTIST	**K.K. Vijayan,** Co-PI
CENTRE	Cochin

- Field samples of farmed shrimp collected from the NACA-ICAR study sites from Andhra Pradesh have been analysed for white spot syndrome virus (WSSV) using PCR and histopathology. Out of the 80 samples screened for WSSV using histopathology, 72 samples tested positive for WSSV, while a large number of samples gave false negative with PCR. These results highlight the need of validation of PCR results, especially in preserved samples.

FUNDING AGENCY	**DST (WOS-A)**
PROJECT TITLE	**Development of immunodiagnostics for the rapid detection of *Vibrio alginolyticus* pathogenic to farmed fish/shellfish**
PI	**Gijo Itoop,** Postdoctoral fellow
MENTOR	**K.S. Sobhana**
CENTRE	Cochin

- Myeloma cell line (SP_2O/Ag-14) was procured from the cell repository of the National centre for cell science (NCCS), Pune. Optimised the culture conditions for the myeloma cell line and the cell line is being maintained for hybridoma work.
- Biochemical characterization of 19 vibrio isolates from diseased fish and shellfish and the type strain (NCTC 10675) have been carried out. Out of these 11 isolates including the type strain were identified as *Vibrio alginolyticus*. These were subjected to pathogenecity evaluation in *Penaeus* (*Fenneropenaeus*) *indicus* and *Siganus canaliculatus* to identify the virulent strains.
- Out of these a highly virulent strain of *Vibrio alginolyticus* (V6) was used for immunization of mice.
- The sensitized spleen cells were collected on day 31 and fusion with myeloma cells was carried out using Polyethylene glycol (PEG).
- Screening assay for identifying the positive hybridoma clones for production of MAb was standardized and the hybridoma clones are being screened for production of MAb by plate ELISA.

FUNDING AGENCY	**ICAR Network Project**
PROJECT TITLE	**Application of microorganisms in agriculture and allied sectors (AMAAS): Microbial diversity and identification: Fish microbes**
SCIENTIST	**Imelda Joseph**
CENTRE	Cochin

- Bacteria were isolated from the gills, viscera and skin of marine fin fishes. Eight bacterial strains (natural flora) from *Mugil cephalus* and five from *Siganus* sp. were isolated and maintained. *Arius* sp., *Coilia* sp., *Anodontostoma* sp. and *Johnius* sp. were also screened for bacteria. Eight strains from *Arius* sp., 10 from *Coilia* sp., 11 from *Anodontostoma* sp. and 10 strains from *Johnius* sp. were also isolated and maintained for further identification.

Technology Assessed & Transferred

Mussel farming in new areas

Mussel farming has been taken up in a big way in the backwater areas of Munambam estuary. Molluscan Fisheries Division conducted 3 training programmes in collaboration with Brackish Water Fish Farmer's Development Agency (BFFDA) for the fishermen of this area. Three farms are at Kottuvallikad and 8 at Moothakunnam. All the farms are of 5m x 5m size and 50 ropes of 1m-seeded length are tied to these racks. BFFDA, Ernakulam gave financial support for all these farmers belonging to 'Kudumbasree' groups to take up mussel farming in the estuary. Molluscan Fisheries Division of the Institute is monitoring environmental characters and mussel production of the farms. About 4-5t production is expected by April-May period.

Agricultural Technology Information Centre (ATIC)

Shri. A.K. Upadhyay IAS, Secretary, ICAR visiting the ATIC

Former Chief Justice Smt. Usha visiting the ATIC

- ATIC has generated an income of Rs 1,10,247 /- from sales and services in the last financial year.
- During 2006-07, 594 farmers, 2,318 students and 63 VIPs' visited ATIC and the total Number of visitors was 2975.
- Organised 56 awareness programmes on Responsible Fisheries Management and Fishery based technologies at ATIC for 1907 beneficiaries. 147 movie shows were also organized on various topics in ATIC for different category of visitors.
- Data were collected seeking the evaluation of ATIC sales & services on technology products, diagnostic services and awareness programmes for impact assessment.
- Among the technological inputs & products highest level of satisfaction was the sale of algal inoculums and aquarium fish feed followed by dry fish products supplied by IVLP Women Self Help Groups.
- Water sample analysis, feed composition analysis and PCR test for detecting the virus infection in shrimp are the major items of satisfaction among the diagnostic services.
- With regard to priced publications, the most preferred published pamphlet was 'Aquarium fish keeping' followed by 'Mussel Farming', 'Marine Ornamental fishes' and 'Marine fisheries management'.
- Among the awareness programmes organized at ATIC, 'Responsible Fisheries Management' scored the highest followed by 'Culture Fisheries' and thirdly the 'Fishery based technologies'.
- The average monthly total of the browsing rate of ATIC website www.aticcmfri.org is about 2006 hits and average daily rate of browsing the site is about 70.

Special Infrastructure Development

Infrastructure facilities developed at CMFRI, HQ, Cochin

- Procured a new High Definition Digital Video Camera for wide coverage of project activities.
- The audio system and projection system of ATIC Audio Visual Hall have improved with latest 5 in 1 home theatre system of US based Klipsch speakers of international standard with wider motorized high grain screen of 12' x 9' dimension.
- Fibre coating to two 100 t seawater storage tanks in the Marine Hatchery.

Infrastructure facilities developed at Regional Centre of CMFRI, Mandapam Camp

- Construction of rain water harvesting system
- Modernization of the Conference Hall
- Library and Guest House
- Renovation of office roofing/flooring
- Re-carpeting of road in residential campus, guest house and office campus.
- A VARIAN model 240 Atomic Absorption Spectrophotometer (AAS) was installed at the Mangalore Research Centre of CMFRI. With this instrument costing about Rs.11 lakhs, the Centre will be capable of analyzing the trace metals in sediments, tissues etc; on a regular basis.

Infrastructure facilities developed at Research Centre, Vizhinjam

- A Quarantine-cum disease treatment unit was set up at Vizhinjam Research Centre for monitoring the health of the marine organisms reared in the hatchery as well as Marine Aquarium at the centre.
- A Central instrument room was developed at Vizhinjam Research Centre for analyzing water and sediment samples, biochemical and histology work with photo-micrographic facilities.

Infrastructure facilities developed at Regional Centre, Veraval

Equipments purchased:

- PC with Printers and UPS (2 nos.), Multiparameter kit for water analysis (1 no.), Electronic balances (2 nos.), PH meter and colorimeter for water analysis (1 no. each), Refrigerator (1 no.), Binocular Microscopes (2 nos.)

Infrastructure facilities developed at Research Centre, Tuticorin

- The laboratory buildings at the South block was made to an amount of Rs.96,320/-
- Hatchery renovation works for Rs. 18 lakhs carried out under 'Seed production in Agriculture crops and Fisheries'.

Equipments :

- Air blower 1; O2 cylinders 3 ;Pumps 3; UV unit 1; Air conditioners 4; FRP tanks 26

The newly installed AAS at the Mangalore Research Centre of CMFRI, Mangalore

Education & Training

Postgraduate Programme In Mariculture

Ph. D. Programme

The following SRFs of regular and sponsored projects of the Institute were awarded Ph.D. Degrees

Name of student	Name of Sup. Teacher	Title of Thesis	University
Joice Abraham	Dr.(Mrs) Mary K. Manisseri	Studies on some aspects of the reproductive physiology of *Metapenaeus monoceros* (Fabricius)	CIFE
Abdul Muneer, P.M.	Dr. A. Gopalakrishnan	Molecular genetic characterization of endemic yellow catfish, *Horabagrus brachysoma* (Gunther)	CUSAT
Jugnu, R.	Dr. (Mrs) V. Kripa	Studies on the prevalence of algal blooms along Kerala Coast, India	CUSAT
Radhika Gopinath	Dr. R. Paul Raj	Aflatoxicosis and its amelioration in black tiger shrimp, *Penaeus monodon* Fabricius	CUSAT

M.F.Sc. (MC) Programme

- Four students have been awarded degree by CIFE (Deemed University) in August, 2006

Krishi Vigyan Kendra

As per the mandatory objectives, the Krishi Vigyan Kendra has organized training programmes for different categories of beneficiaries, Front Line Demonstration programmes, Onfarm testing programmes and other extension activities during the year under report, aimed at promoting area development, employment generation, technology upgradation and increasing production in agricultural and allied sectors.

Training programmes

Training courses were organized, on-campus as well off-campus for the benefit of practicing farmers, rural youth and extension personnel.

a. Practising farmers (On-campus)

Discipline	Course Title	No. of courses conducted	Number of participants Male	Female	Total	SC
Fisheries						
Agriculture						
Home Science	Preparation of diversified value added fish products	1	1	5	6	nil
	Total (a)	1	1	5	6	nil

b. Practising farmers (Off campus)

Discipline	Course Title	No. of courses conducted	Number of participants Male	Female	Total	SC
Fisheries	Mud crab fattening & farming	1	14	6	20	nil
Agriculture	Coconut cultivation	1	13	7	20	5
Home Science	i. Preparation of diversified value added fish products	2	2	44	46	5
	ii. Preparation of diversified value added products from fruits & vegetable	1	-	10	10	3
	Total (b)	5	29	67	96	13

c. Rural Youth (On campus)

Discipline	Course Title	No. of courses conducted	Number of participants Male	Female	Total	SC
Fisheries	Ornamental fish culture	1	1	12	13	nil
Agriculture	Mushroom spawn production	5	37	73	110	13
Home Science	i. Detergent & Toilet soap making	4	nil	34	34	18
	ii. Preparation of diversified value added fish products	4	1	77	78	9
	iii. Preparation of diversified value added products from fruits & vegetable	1	nil	20	20	1
	Total ©	15	39	216	255	41

d. Rural Youth (Off campus)

Discipline	Course Title	No. of courses conducted	Number of participants			
			Male	Female	Total	SC
Fishereis	i. Fresh water fish farming	2	48	13	61	nil
	ii. Crab fattening & farming	2	32	15	47	5
	iii. Improved traditional shrimp farming	1	16	nil	16	4
	iv. Ornamental fish farming	2	4	95	99	1
	v. Mussel farming	2	1	29	30	2
	vi. Edible oyster farming	1	nil	15	15	1
Agriculture	i. Vermi compost making	5	20	73	93	6
	ii. Mushroom cultivation	15	77	243	320	28
Home Science	i. Preparation of diversified value added fish products	7	10	140	150	46
	ii. Preparation of diversified value added products from fruits	7	2	141	143	23
	iii. Mushroom pickle making	1	8	17	25	nil
	iv. Toilet soap making	3	nil	40	40	18
	v. Dish washing powder making	2	nil	25	25	10
	Total (d)	50	218	846	1064	144

e. Extension workers

Discipline	Course Title	No. of courses conducted	Number of participants			
			Male	Female	Total	SC
Fisheries Agriculture Home Science	Diversification in coastal aquaculture	1	5	7	12	nil
	Total (e)	1	5	7	12	nil

f. Extension workers

Discipline	Course Title	No. of courses conducted	Number of participants			
			Male	Female	Total	SC
Fisheries Agriculture Home Science	Mushroom cultivation	3	17	22	39	nil
	Total (f)	3	17	22	39	nil
	Total of (a)+(b)+(c)+(d)+(e)+(f)	75	309	1163	1472	198

Front Line Demonstration [FLD] & On Farm Testing [OFT]

Discipline	Programmes	
	Activities under FLD	Activities under OFT
Fisheries	Feed management in breeders and young ones of freshwater ornamental fishes using the Formula feed developed by PNP Division of CMFRI, as input at three selected breeding centers at Kothamangalam, Poothotta and Nayarambalam in Ernakulam District.	i. Polyculture of different species of carps such as Catla, Rohu and Mrigal in five household tanks in Vengola village near Perumbavoor in Ernakulam District ii. Farm testing of the effect of application of Neem cake and Methylene blue for managing bacterial and fungal infections in Tiger shrimps in five selected farms in Nayarambalam Village
Agriculture	Integrated nutrient management in coconut using Neem cake and Magnesium sulphate in four selected farms in Edavanakkad village in Ernakulam District	i. Integrated pest management in Banana using Pheromone trap for Rhizome weevil, implemented in two farms in Manjali village near Alwaye ii. Integrated nutrient management in Jasmine using Neem cake, implemented in two farms in Arakkappady village near Perumbavoor
Home Science	Installation and operation of 'Smokeless choola' for drudgery reduction and energy saving in cooking, demonstrated in two houses in Elankunnapuzha village in Ernakulam District	i. Use of 'Janatha cooler' for increasing storage life of vegetables and fruits was demonstrated in two houses in Narakkal village ii. Use of 'Hay Box' for energy saving in cooking was demonstrated in two houses in Kumbalangi village in Ernakulam District

Conduct of Seminar/Mahila Meet/Fishermen/Farmers' Meet :

Sl.No	Date	Nature of activity	Place
1	02-06-2006	Mahila Meet (Home Science)	Edavanakadu
2	07-06-2006	Group discussion (Home Science)	KVK campus
3	16-06-2006	Mahila Meet (Home Science)	KVK Campus
4	17-06-2006	Mahila Meet (Home Science)	Angamaly
5	19-06-2006	Mahila Meet (Home Science)	Edavanakadu
6	14-07-2006	Mahila Meet (Home Science)	KVK Campus
7	14-07-2006	Mahila Meet (Home Science)	Edavanakadu
8	17-08-2006	Farmers Meet (Agriculture)	Krishi Bhavan, Puthencruz
9	22-09-2006	Mahila Meet (Home Science)	KVK Campus
10	08-10-2006	Mahila Meet (Home Science)	Kolencherry
11	11-12-2006	Farmers Meet (Agriculture)	Fisheries College, Panangadu
12	12-01-2007	i. Fishermen Meet held on 12-1-2007 at KVK campus discussed marine environment, fishery resources and their conservation along the Kerala Coast' under the leadership of Dr. C. Ramachandran, Senior Scientist, CMFRI, Cochin; 40 fishermen participated.	KVK Campus
13	19-01-2007	Farmers Meet (Agriculture)	Nedumbasserry
14	03-02-2007	Celebration of Foundation Day of CMFRI at KVK campus on 3-2-2007; 125 participants including farmers, fishermen, farm labors, Panchayat President, Panchayat Members and representatives from different State Departments.	KVK Campus
15	07-02-2007	General Awareness programme held at Udayamperoor on 7-2-2007 discussed training and other extension programmes organized by the KVK for rural women empowerment; 25 women of the Microfinance group participated.	Udayamperoor
16	15-03-2007	Harvest Mela of Mussels farmed by one of the beneficiaries, facilitated by the Mariculture & Molluscan Fisheries Divisions and KVK was arranged on 15-3-2007; 50 people participated.	KVK Campus

A farmer (left) receiving neem cake under onfarm testing programme

Preparation of fish wafers

Preparation of pickles by women trainees

Faculty Improvement

The following personnel were deputed for training during the year

i. Shri. B. Sureshkumar, Technical Officer T-5 : a) Training course on Mushroom spawn production & cultivation organized by the National Research Center on Mushroom, Champaghat, Solan, Himachal pradesh during 17-19 July, 2006 b) 10 days training on 'Mass production technology of Biological control Agents', organized by National Centre for Integrated Pest Management (ICAR), New Delhi, during 12 - 23 December, 2006.

ii. Shri. J. Narayanaswamy, Technical officer T-5 and

iii. Smt. P. Sreeletha, Technical Officer T7-8 : 'Orientation training for Subject Matter Specialists of KVKs, organized by Kerala Agricultural University at Trichur during 12 - 13 March, 2007.

Collaborative programmes under external funding

The National Fisheries Development Board has approved two proposals submitted by the KVK for implementation with a financial outlay of Rs.4.935 lakhs, covering training and demonstration programmes for 120 beneficiaries in coastal aquaculture and 60 beneficiaries in fish processing (value addition). Necessary fund has been released by the NFDB and the activities are in progress.

Meetings attended with respect to Scientific and technical Committees

Dr. P. M. Aboobaker, Technical Officer attended the District Nodal Agency Meeting and District Watershed Committee Meeting held at the Office of the Principal Agricultural Officer at Collect orate, Ernakulam on 24-8-2006 and 21-12-2006, ii) District Micro irrigation Committee Meeting on 19-2-2007 at Collect orate, Ernakulam and National Agricultural Implementation Programme Workshop held at CMFRI on 16-9-06 as a member.

Dr. K. Asokakumaran Unnithan, Scientist-in-charge of KVK attended the Scientific Advisory Committee Meeting of the KVK of Kerala Agricultural University at Trichur on 27-3-2007.

Important visitors

i. Shri. A. K. Upadhyay, IAS. Additional Secretary, DARE & Secretary, ICAR accompanied by Prof. Dr. Mohan Joseph Modayil, Director, CMFRI visited the KVK on 31-1-2006.

ii. Dr. P.Paul Pandian, Dy. Advisor (Fy), Planning Commission, Govt. of India, New Delhi visited the KVK on 22-3-2007.

Community service programme

As a part of the community service programme initiated at the KVK towards empowering rural women, they are offered necessary guidance and facilities for preparing detergent powder, toilet soap and diversified value added products from fruits, fishes and prawns for their household use.

Awards & Recognitions

- CMFRI won the Best ICAR Annual Report Award for the year 2004-2005. The Editorial Committee and other personnel associated with the compilation and publication of the Issue included Dr. E.V.Radhakrishnan, Dr.P. Jayasankar, Dr.K. Sunilkumar Mohamed, Dr.L.Krishnan, Smt. P.J.Sheela and Ms. Manjusha G. Menon.

  Dr.M.Rajagopal & Shri. Anoop A Krishnan provided the cover photogaph of the Annual Report 2004-2005.

- Prof. (Dr.) Mohan Joseph Modayil, Director, Central Marine Fisheries Research Institute, Cochin was awarded the degree of Doctor of Science by the Kerala University in Aquatic Biology and Fisheries for his thesis "An inquiry into the biotic potential, environmental resistance, sustainability and utilization of certain marine fishery resources of the Indian seas".

- Dr. N.G.K. Pillai, Head, Pelagic Fisheries Division and Dr.R.Sathiadhas, Head, Socio-Economic Evaluation and Technology Transfer Division serving as members of the Expert Committee constituted by the Government of Kerala to study the impact of fishing ban on marine fisheries along the coast of Kerala.

- Dr. N.G.K. Pillai served as a Member in the Committee constituted by the Government of Goa to formulate a state policy for the development of the Traditional fisheries in the State with a sustainable management of the resources.

- Dr. N.G.K. Pillai, served as a member of Task force on Marine Fisheries development of Kerala constituted by the Government of Kerala.

- Dr. N.G.K. Pillai, served as a member of Expert Committee for aquarian reforms in the fisheries sector constituted by the Government of Kerala.

- Dr. N.G.K. Pillai, serving as member of Reconstituted Faculty of Marine Sciences of Cochin University of Science and Technology.

- Dr.C.P. Suja received the ICAR Jawaharlal Nehru Award, 2005 for the Ph.D thesis "Mantle tissue culture of abalone Haliotis varia Linnaeus" on August 18th 2006 at New Delhi.

- Dr. K.K. Vijayan, Head PNP Division has been awarded the DBT Biotechnology Overseas Associateship 2005-2006 at University of Liege, Belgium, for a period of 5 months and 3 weeks.

- Dr.E.V.Radhakrishnan, Head, Crustacean Fisheries Division won First Prize for Hindi Implementation for maximum usage of words in Hindi in the Institute.

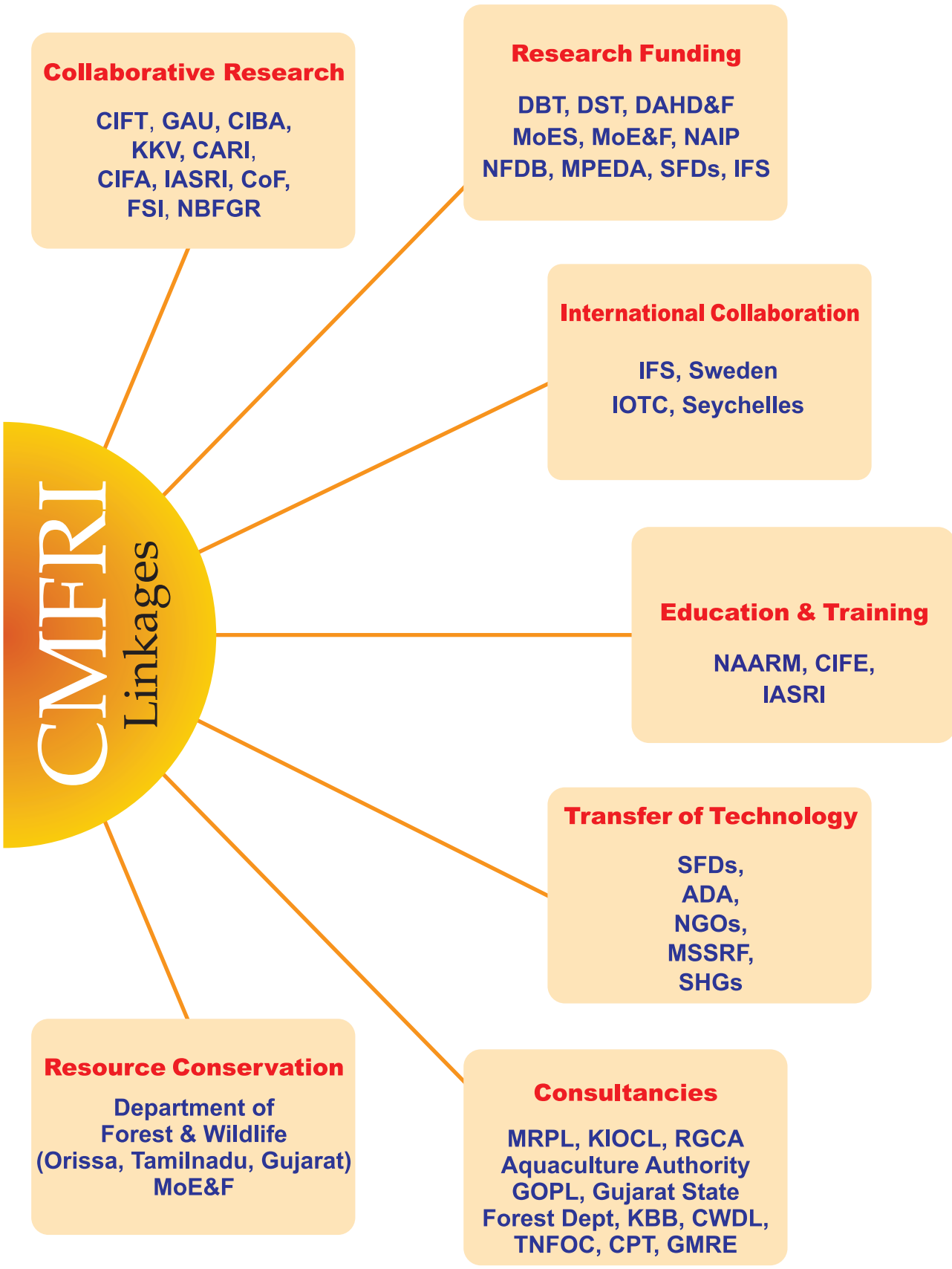
- Dr. Imelda Joseph won Third prize in Hindi Poster competition conducted during Hindi Chetana Maas celebrations of CMFRI.

- Dr. Imelda Joseph has won First Prize in the Quiz Competition conducted in Connection with the CMFRI Diamond Jubilee Celebrations.

Dr. C. Ramachandran receiving the Japan International Fisheries Research Society 'Yamamoto' prize

Dr. V. P. Vipinkumar receiving the Award of Indian Society of Extension Education

- Dr.R.Sathiadhas was nominated as the member of Indo- Thailand Free Trade Agreement Impact Committee.
- Dr.C.Ramachandran, Scientist (SS), received the award of Japan International Fisheries Research Society (JIFRS) 'Yamamoto' price and was invited for paper presentation in IIFET Biennial Conference during the period from 10th to 14th July 2006 at University of Portsmouth, UK.
- Dr.Vipinkumar.V.P, Scientist (SS), won the national award of Indian Society of Extension Education (ISEE), New Delhi for presenting the 'Best Research Paper' in the National Seminar on "Information and Communication Technology :Opportunities & Challenges for Revitalizing Extension System" organized at Navsari Agricultural University, Gujarat during 27th to 29th December, 2006. The awards were presented by Gujarat State Food Minister Shri.Chatrasingh Mori, in the presence of Dr.R. P.S.Ahlawat, Vice Chancellor of NAU and other dignitaries.
- Shri.A.P. Dineshbabu, Scientist (SG) of the Mangalore Research Centre of CMFRI was awarded Ph.D degree for his thesis entitled "Biology, population characteristics and fishery of the Ridge Back Shrimp, Solonocera Choprai, Natraj, 1945 along South Karnataka coast, India" by the Mangalore University.
- Shri. K.Vijayakumaran, Scientist (SG), Mangalore Research Centre of CMFRI was awarded Ph.D degree for his thesis entitled "Sustainability of Fishing Operations along the Upper East Coast of India- A Techno-bio-economic study" by Dr.B.R.Ambedkar Open University, Hyderabad.
- Shri.K.K.Philipose, Scientist (SG), Calicut Research Centre of CMFRI was awarded Ph.D degree for the thesis "Distribution of marine ornamental fishes along the Malabar coast with studies on the biology of important species" by the Calicut University.
- In the Hindi competition conducted by Mangalore Town Official Language Implementation Committee during the Hindi month celebrations, Shri G.Subramanya Bhat Technical Officer (T-5) won the second prize in Hindi translation and third prize in functional Hindi grammar competitions.
- Vizhinjam Research Centre bagged the Best Institutional Award for Marine Aquarium in the Flower Show and Aqua Show organized in Trivandrum during January 2007.
- Dr. P. Jayasankar, Senior Scientist, PNP Division was inducted as a member under Indian Regional Working Group of FISHBOL (Fish Barcode of Life Initiative), a global effort to coordinate assembly of standardized reference sequence library of all fish species. He was also identified as the assessor of the grouper species Epinephelus diacanthus in the red list assessment of IUCN.


CMFRI Linkages
Collaborative Research
CIFT, GAU, CIBA,
KKV, CARI,
CIFA, IASRI, CoF,
FSI, NBFGR
Research Funding
DBT, DST, DAHD&F
MoES, MoE&F, NAIP
NFDB, MPEDA, SFDs, IFS
International Collaboration
IFS, Sweden
IOTC, Seychelles
Education & Training
NAARM, CIFE,
IASRI
Transfer of Technology
SFDs,
ADA,
NGOs,
MSSRF,
SHGs
Consultancies
MRPL, KIOCL, RGCA
Aquaculture Authority
GOPL, Gujarat State
Forest Dept, KBB, CWDL,
TNFOC, CPT, GMRE
Resource Conservation
Department of
Forest & Wildlife
(Orissa, Tamilnadu, Gujarat)
MoE&F

Publications

- Indian Journal of Fisheries
- Marine Fisheries Information Service
- Bibliography on Tunas
- Newsletter
- Matsyagandha No. 91
- Monograph on the Planktonic Shrimps

Journals (peer reviewed)

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Approved Ongoing Projects

In-house Projects

SL. NO.	Project Code No.	Title of the Project
1	FRA/ASSESS/01	Assessment of exploited marine fishery resources
2	FRA/ASSESS/02	Stock assessment techniques in marine fish and shellfish resources and management
3	FEM/01	Monitoring the environmental characteristics of the inshore waters in relation to fisheries
4	FEM/02	Monitoring environmental contaminants from coastal waters with reference to bioaccumulation and biomagnification in fishes
5	FEM/04	Development of strategies for sea turtle and sea cucumber conservation
6	FEM/07	GIS based atlas on potential mariculture sites along Indian coasts
7	PNP/NUT/01	Development of cost- effective and eco-friendly feeds for cultivable marine crustaceans and finfish by biotechnological interventions
8	PNP/BIOT/01	Biotechnological interventions in disease diagnosis and management in mariculture
9	SEE/PMS/01	Price behaviour and marketing system of marine fisheries in India
10	SEE/ECO/01	Economics of marine fishing operations and social costs/benefits
11	MBD/01	Studies on the coral biodiversity of the Gulf of Mannar Biosphere Reserve
12	MBD/02	Species diversity of exploited marine fishery resources of Indian coasts
13	MBD/03	Studies on the specific and intra specific diversity of carangids of the Indian seas
14	MD/CUL/03	Broodstock development and seed production of finfishes
INTER-DIVISIONAL PROJECTS		
1	DEM/IDP/01	Appraisal of marine fisheries of Gujarat
2	CF/IDP/03	Appraisal of marine fisheries of Maharashtra
3	PEL/IDP/02	Appraisal of marine fisheries of Goa & Karnataka
4	PEL/IDP/01	Appraisal of marine fisheries of Kerala
5	DEM/IDP/02	Appraisal of marine fisheries of Tamil Nadu& Pondicherry
6	MF/CAP/01	Appraisal of marine fisheries of Andhra Pradesh
7	DEM/CAP/03	Appraisal of marine fisheries of Orissa
8	FRA/IDP/01	Appraisal of marine fisheries of West Bengal
9	PEL/IDP/03	Appraisal of marine fisheries of the Lakshadweep Islands
10	MF/CAP/02	Building trophic models and fisheries management simulations for the Indian Seas: Part 1 - Northwest coast (NWC) and Gulf of Mannar (GOM) ecosystems
11	CF/IDP/02	Studies on discards and low value bycatch of trawlers
12	SEETTD/IM/01	Impact of management and technological interventions on marine fisheries and coastal livelihood
13	CF/IDP/01	Impact of selective fishing of juvenile and brood fish, FADs and sea ranching on stock health
INTER-INSTITUTIONAL IN-HOUSE COLLABORATIVE MODE PROJECTS		
1	Genetic divergence studies in prioritized marine finfish and shellfish	

Sponsored Projects

SL. NO.	Project Code No.	Title of the Project
1.	ERP/MPD/04	Participatory management and conservation of lobster resources along the south west coast of India
2.	ERP/DOD/09	Farming and pearl production in Blacklip pearl oyster *Pinctada margaritifera* in Andaman waters
3.	ERP/DOD/10	Studies on marine mammals of Indian Exclusive Economic Zone and the contiguous seas
4.	ERP/DOD/11	Predictive modeling of marine fisheries of the south west coast of India
5.	ERP/APC/25	Economic evaluation of trawl fishing in Andhra Pradesh and Kerala
6.	ERP/APC/24	Cattle feed production from selective seaweeds of Indian coast
7.	ERP/APC/19	Technological upgradation of edible oyster farming through development of remote setting and upwelling techniques
8.	ERP/APC/29	Seed production, farming and production of soft shelled crabs of *Portunus pelagicus* (Linnaeus)
9.	ERP/APC/26	Assessing the impact of fishing on the biodiversity pattern of commercial marine fishery resources of South west coast of India
10.	ERP/APC(Net)/38	Impact, adaptation and vulnerability of Indian Agriculture to climate change
11.	ERP/DOD/14	Tuna resources of the Indian EEZ-An assessment of growth and migratory patterns
12.	ERP/DOD/13	Resource assessment and biology of deep sea fishes along the continental slope of Indian EEZ
13.	ERP/MoA/01	Floating cage farm for marine finfish and shellfish
14.	ERP/DSR-ICAR/01	Seed production in agricultural crops and fisheries
15.	ERP/DBT/10	Development of gene constructs for production of WSSV resistant penaeid shrimp and its validation in shrimp cell culture system
16.	ERP/DBT/09	Development and application of CMG family recombinant hormones, their antagonistics and RANi technique for induced maturation and spawning of *Penaeus monodon*
17.	ERP/APC(Net)/54	Investigation on 'Loose Shell Syndrome' among farmed tiger shrimp *Penaeus monodon*
18.	ERP/APC(Net)/55	Impact of fisheries research in India

Consultancies, Sequence Submissions & Patent Filing

Consultancies during the year 2006-2007

Sl.No	Name of Client	Project Title	Duration	Amount (Rs.)
1	M/s.KIDS, Kottapuramm, Kodungallur-680667	Health management of Lates calcarifer cage culture	April 2006 - May2007.	1,50,718
2	M/s.KIOCL, Kudremukh, Mangalore	Studies on siltation in Bhadra river in the mining area of KIOCL Phase-3	July 2006-December 2006	5,61,200
3	M/s.NEERI, Mumbai Zonal laboratory, Worli, Mumbai-400018	Post-commissioning environmental impact assessment of sewage outfall operations on the fishery of the west coast of Mumbai	November 2006-July-2007	5,60,000
4	M/s.GMR Energy Ltd, Mangalore	Monitoring studies on the hydrobiological conditions in the Arabian sea off Thanirbavi power plant facility of M/s.GMR Energy Ltd, Mangalore	October 2006 July 2007	4,17,829
			Total Amount	**16, 89,747**

Gene/ DNA Sequence submissions

Sl.No.	Gene/DNA Sequence definition	GenBank Accession number	Authors
1	*Stenella longirostris* isolate CH07 mitochondrial control region, partial sequence.	EF057435	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
2	*Stenella longirostris* isolate CH6 Cytochrome b (cytb) gene, partial cds; mitochondrial	EF057434	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
3	*Stenella longirostris* isolate CH9 cytochrome b (cytb) gene, partial cds; mitochondrial.*Stenella longirostris* isolate CH9 mitochondrial control region, partial sequence.	EF057436 EF438306	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
4	*Stenella longirostris* isolate CH17 cytochrome b (cytb) gene, partial cds; mitochondrial.*Stenella longirostris* isolate CH17 mitochondrial control region, partial sequence.	EF057437 EF438309	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
5	*Stenella longirostris* isolate CH18 Cytochrome b (cytb) gene, partial cds; mitochondrial.	EF057438	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
6	*Stenella longirostris* isolate VRC/Dol/06 Cytochrome b (cytb) gene, partial cds; mitochondrial.	EF057433	Jayasankar, P, Anoop, B., Rajagopalan, M. and Yousuf, K.M.M.

7	*Stenella longirostris* isolate CH19 Cytochrome b (cytb) gene, partial cds; mitochondrial*Stenella longirostris* isolate CH19 mitochondrial control region, partial sequence.	EF446613 EF438303	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
8	*Stenella longirostris* isolate CH13 Cytochrome b (cytb) gene, partial cds; mitochondrial	EF446614	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
9	*Stenella longirostris* isolate CH03 mitochondrial control region, partial sequence.	EF438307	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
10	*Delphinus tropicalis* isolate MNG18 cytochrome b (cytb) gene, partial cds; mitochondrial	EF061405	Jayasankar, P., Anoop, B., Rajagopalan, M., Anoop, A.K. and Krishnakumar, P.K.
11	*Sousa chinensis* isolate MNG16 mitochondrial control region, partial sequence*Sousa chinensis* isolate MNG16 Cytochrome b (Cytb) gene, partial cds; mitochondrial	EF061406 EF057445	Jayasankar, P., Rajagopalan, M., Anoop, B., Reynold, P., Krishnakumar, P.K. and Anoop, A.K.
12	*Stenella attenuata* isolate CH5 Cytochrome b (Cytb) gene, partial cds; mitochondrial*Stenella attenuata* isolate CH5 mitochondrial control region, partial sequence	EF438304 EF438305	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
13	*Grampus griseus* isolate CH15 mitochondrial control region, partial sequence	EF438308	Jayasankar, P, Anoop, B., Rajagopalan, M, Kumaran, P.L. and Vivekanandan, E.
14	*Balaenoptera musculus* isolate M5 mitochondrial control region, partial sequence *Balaenoptera musculus* isolate M5 Cytochrome b (Cytb) gene, partial cds; mitochondrial	EF057441 EF057442	Jayasankar, P., Anoop, B., Rajagopalan, M. and Afsal, V.V.
15	*Balaenoptera edeni* isolate M6 mitochondrial control region, partial sequence*Balaenoptera edeni* isolate M6 Cytochrome b (cytb) gene, partial cds; mitochondrial	EF057443 EF057444	Jayasankar, P., Anoop, B., Rajagopalan, M. and Afsal, V.V.
16	*Dugong dugon* isolate M4 mitochondrial control region, partial sequence*Dugong dugon* isolate M4 Cytochrome b (cytb) gene, partial cds; mitochondrial	EF057439 EF057440	Jayasankar, P., Anoop, B., Rajagopalan, M. v Afsal, V.V.

International Patent Filing

Received the International Patent Filing Number: PCT/IB2006/003299 from the patent attorney's office for the patent '*In-vitro* pearl production using marine organisms' filed by Dharmaraj, S., Suja, C.P.

Meetings

INSTITUTE MANAGEMENT COMMITTEE

The 64th IMC of CMFRI was held on 04.10.2006 at CMFRI, Kochi. Minutes of the 63rd meeting of IMC held on 22.03.2006 was approved. The new items approved in the 64th IMC meeting: – (i) The Estimate for Rs.30.06 lakh for the renovation work of existing Marine Hatchery at CMFRI, Kochi under the funded project entitled "Seed production of Marine Fin fish & shell fish, (ii) Meeting an expenditure of Rs.3,77,066/- towards the 50% share payable by CMFRI to CIFT, Kochi for the urgent repair work of lab-cum-office building of CMFRI & CIFT at Veraval necessitated due to the earthquake in Gujarat in 2001, from the provision of Rs.6.90 lakh made in the X Plan EFC of CMFRI towards the original work of the same building, (iii) Procurement of one underwater digital camera in lieu of the provision made in the EFC for purchase of two Nos. of Air Blowers costing Rs.70,000/-, (iv) Review of Transfer guidelines in respect of ARS Scientists of CMFRI within the Institute from one station to another, (v) Diamond Jubilee Celebration of CMFRI, (vi) Additional provision under Non-Plan 2006-07 for Re-flooring of the existing lab-cum-office building of CMFRI, Kochi (1st to 4th Floor), (vii) Provision of two Reverse Osmosis Plants of 2000 LPH capacity for Drinking water requirements at Mandapam Regional Centre of CMFRI, Mandapam Camp.

The 65th IMC of CMFRI was held on 21.03.2007 at CMFRI, Kochi. Minutes of the 64th meeting of IMC held on 04.10.2006 was approved. The new items approved in the 65th IMC meeting: – (i) Proposal for nomination of members to the Institute Grievance Committee, (ii) Awarding contract for security services at CMFRI Hqrs., Kochi and its Regional/Research Centres, exceeding the limit of Rs.12.50 lakh per annum, (iii) Maintenance/petty works under taken under Non-Plan 2006-07 at CMFRI, (iv) Appointment of AMA at Mumbai R.C. of CMFRI.

SRC

The 13th Staff Research Council meeting was held from 13 to 15 November, 2006 at CMFRI Headquarters, Cochin. Prof. (Dr.) Mohan Joseph Modayil, Director, CMFRI and Chairman, SRC presided over the meeting. The Chairman in his address called upon the Scientists to restructure the projects on problem solving mode to find out solution for the major problems confronting the marine fisheries of the country. Dr. E.V. Radhakrishnan, Secretary, SRC welcomed the Chairman and all members who attended the meeting. The meeting was attended by Heads of Divisions, Scientists-in-Charge of Centres, Principal Investigators of ongoing in-house research projects and all scientists at Headquarters. The progress of research under the inhouse projects were presented by the Principal Investigators and critical appraisal of each project was carried out. The SRC decided to close X plan inhouse research projects by 31 March 2007. The Chairman suggested that 20 solution-based projects may be formulated for presentation and approval in the 14th SRC meeting under XI Plan.

Participation of Scientists in conferences, meetings, workshops, symposia and training in India and abroad

Prof. (Dr.) Mohan Joseph Modayil, Director participated in the following meetings

IJSC meeting of the Institute at Mangalore Research Centre of CMFRI, Mangalore (7th -11th April).

Meeting with Convener, 7th Asian Fisheries Forum at Bangalore (15th - 18th April).

Foundation Stone Laying ceremony for the proposed hatchery complex at Mandapam Regional Centre of CMFRI (18th 20th May).

National Consultation on Water Management in Fisheries and Aquaculture organized by Association of Aquaculturists, Inland Fisheries Society of India, CIFA, Bhubaneswar and CIFRI, Barrackpore (22nd – 29th June).

The releasing ceremony of Marine Fisheries Census report at New Delhi and to carryout location, identification survey for the open sea cage mariculture project and finalization of logistics for cage installation at Visakhapatnam (24th -29th July).

Inaugural ceremony of the Summer School on 'Recent advances in Seed production and grow out Techniques for Marine Finfishes and shell fishes' at Mandapam Camp and delivered two lectures(6th - 8th August).

Meeting to discuss and finalize the perspective plan documents at New Delhi (27th - 30th August).

Inaugural function of the National Fisheries Development Board at the Auditorium of the A.N.G. Ranga University, Rajendranagar, Hyderabad (7th - 10th September).

Meeting of the committee under the chairmanship of Dr.N.K.Tyagi, Member, ASRB constituted to modify the performa for assessment for Senior. Scientist to Principaal Scientist under Career Advancement Scheme of ARS at New Delhi (13th - 15th September).

Vigilance training at NAARM, Hyderabad (17th - 21st September).

The XIth Plan meeting, Seed Certification meeting and Director's Conference of ICAR Institutes at New Delhi (30th October – 5th November).

The Public/Private partnership meeting in the Kemin Nutritional Technology at Chennai (7th - 8th November).

The International Conference in Zoology INCOZ-2006 at Bangalore (20th - 22nd November).

The NACA Lead Centres Meeting at Bangkok, (25th – 29th November).

The Official Language (Hindi) Implementation inspection meeting in connection with the visit of Second Sub-Committee of Parliamentary Committee on Official language at Cochin (12th October, 2006) and Veraval (12-15, February,2007)

The International Seminar and Inspection of the Mangalore RC of CMFRI at Mangalore (19th – 22nd December).

Evaluation of Cage culture project at Diu and Ratnagiri (14th - 18th February).

Meetings with Joint Commissioner, Joint Secretary and Secretary, Ministry of Agriculture, New Delhi (23rd February).

Review Meeting of Mega Seed Project at New Delhi (1st - 2nd March).

Presided over the inaugural function of the MPEDA funded project "Participatory Management and Conservation programme of Lobster Resources along the Indian Coast" at Export Fish Landing Centre, Fisheries Harbour, Kasimedu, Chennai (6th March).

Chairman of the selection committee for the post of Technical assistant (T3) at Visakhapatnam Regional Centre of CMFRI (13th March, 2007).

Scientists of the Institute participated in the following conferences, meetings, workshops, symposia and training programmes

Meeting of the Heads of Central Government Fisheries Research Organizations convened by Shri. S. Sharma, Hon'ble Minister of Fisheries & Registration to conduct a Workshop to evolve a Master Plan for the development of fisheries sector in Kerala (2nd July, 2006) - ***Dr. N.G.K. Pillai***

Presented a paper on *Trend of fish production from coastal waters of Kerala: Approaches towards sustainable exploitation* in the Workshop 'Sustainable development of fisheries in Kerala' organized by Department of Fisheries, Govt. of Kerala at CMFRI, Kochi (22nd and 23rd July,2006) - ***Dr. N.G.K. Pillai***

Meeting in connection with the construction of ice plants in Lakshadweep islands at Lakshadweep Development Corporation Ltd, Panampilly Nagar (29th July,2006) - ***Dr. N.G.K. Pillai***

Second meeting of XI Plan Working Group on Fisheries at Central Inland Fisheries Research Institute, Barrackpore, Kolkatta (21-22nd August,2006) - ***Dr. N.G.K. Pillai***

Meeting on the Workshop on Sustainable Fisheries for Kerala for preparation of Master Plan organized by Department of Fisheries, Govt. of Kerala at Integrated Fisheries Project, Kochi (31st August,2006) - ***Dr. N.G.K. Pillai***

First meeting on Trawl Ban Committee organized by Department of Fisheries, Govt. of Kerala at IFP, Kochi (31st August,2006) - ***Dr. N.G.K. Pillai and Dr.R.Sathiadhas***

Meeting on Master Plan for the development of the fisheries of Kerala at IFP, Ernakulam (29th September,2006) - ***Dr. N.G.K. Pillai***

Meeting of Fifteenth Consultative group meeting of Cochin Base of Fishery Survey of India under the chairmanship of Director of Fisheries, Government of Kerala at Cochin Base of Fishery Survey of India (7th October,2006) - ***Dr. N.G.K. Pillai***

Meeting on Pilot project undertaken by UNCTAD, MPEDA and SEAI with the experts from CIFT, LDCL, Department of Fisheries, LCMF, NABARD, CIFNET and CMFRI at MPEDA, Kochi (9th October,2006) - ***Dr. N.G.K. Pillai***

Conducted two sessions of classes in the UGC sponsored training programme on *Modern Approaches in Fisheries Science* at School of Industrial Fisheries organized by Cochin University of Science and Technology, Cochin (25 October,2006) - ***Dr. N.G.K. Pillai, Dr.E.V.Radhakrishnan and Dr.K.S.Mohamed***

Participated in a two day Seminar on *Contribution of Science and Technology in the development of Kerala* organized by CUSAT, Kochi (19-20th December,2006) - ***Dr. N.G.K. Pillai, Dr.E.V.Radhakrishnan, Dr.M.Rajagopalan, Dr.R.Sathiadhas, Dr.K.K. Vijayan, Dr.K.S. Mohamed and Dr. D. Prema***

Second Meeting of the Trawl Ban Committee conducted by the Department of Fisheries, Govt. of Kerala at CMFRI, Kochi (6th January,2007) - ***Dr. N.G.K. Pillai, and Dr.R.Sathiadhas***

Meeting of FSI and Nodal Officers with World Bank Team to discuss about the issues to be addressed on different international requirements arising out of various agreements convened by DAHD&F, Ministry of Agriculture, Krishi Bhavan, New Delhi (12th January,2007) - ***Dr. N.G.K. Pillai***

Meeting of MSC organized by MPEDA at Abad Plaza, Cochin (15th January,2007) - ***Dr. N.G.K. Pillai, Dr.E.V.Radhakrishnan, Dr.K.S. Mohamed and Dr.M.Srinath***

Participated in the Workshop on the *Enhancing Skills for Research & Development in Marine Fisheries* organized by CMFRI, Kochi as part of the Diamond Jubilee Celebrations at International Hotel, Kochi (4 -7 February, 2007) – ***All Scientists of CMFRI at Cochin***

Participated in the Workshop on the *Prospects of diversification of Aquaculture in Kerala* organized by Agency for Development of Aquaculture, Kerala (23rd February,2007) - ***Dr. N.G.K. Pillai***

Attended as an Expert in the Round Table Discussion on Fisheries Resource Management of Kerala conducted by the South Indian Federation of Fishermen Societies, Trivandrum (16th March,2007) - ***Dr. N.G.K. Pillai***

Participated in the Workshop on *Responsible fisheries – Strategies and practices* organized by Madras Research Centre of CMFRI at Department of Management Studies, Anna University Campus, Chennai (26-27th March,2007) - ***Dr. N.G.K. Pillai, Dr.E.Vivekanandan and Dr.C. Ramachandran***

Meeting on Trawl Ban Committee conducted by the Fisheries & Ports (B) Department, Government of Kerala, Thiruvananthapuram (28th March,2007) - ***Dr. N.G.K. Pillai, and Dr.R.Sathiadhas***

Attended Farmers training programme organized by the Minicoy Regional Station of the CPCRI (16th &17th May,2006)- ***Shri. K.P. Said Koya***

Meeting on Consultancy project on 'Rapid Impact Assessment of high saline effluent from the proposed Desalination Plant' at Madras Research Centre of CMFRI and at CMFRI, Cochin (15th – 17th May,2006, 19-21st June,2006 and 29th – 31st June,2006) – ***Dr. H. Mohamad Kasim***

Meeting of the Consultative Group of Chennai Base of Fishery Survey of India at FSI, Chennai (20th October,2006) - ***Dr. H. Mohamad Kasim***

State Level Committee Meeting of Gulf of Mannar Biosphere Reserve Trust at E&F Secretariat, Chennai (19th December,2006) - ***Dr. H. Mohamad Kasim***

Attended the one day Regional Workshop on *Marine Fisheries of Malabar Coast, management and prospective* organized by Zonal Director, FSI, Cochin at Kannur (8th December,2006) - ***Dr. P.N.Radhakrishnan Nair***

Second meeting of Scientific Advisory Committee on Marine Living Resources Programme (SAC-MLRP) and to present the progress of the project on 'Black lip pearl oyster *Pinctada margaritifera* in Andaman & Nicobar Islands' (25-25, July, 2006) – ***Dr. E. Vivekanandan and Dr. K.S. Mohamed***

Attended the summer school on 'Recent advances in seed production and grow out techniques for marine finfish and shellfish' organized by CMFRI at Mandapam Regional Centre, as a resource person (7- 27th August, 2006)- ***Dr. G. Gopakumar, Dr. K.S. Mohamed, Dr.M.Rajamani, Shri. Joe k.Kizhakudan, Dr.G.Syda Rao, Dr. E.V. Radhakrishnan, Dr.V..Kripa, Dr.L. Krishnan, Dr. Josileen Jose and Dr. Boby Ignatius***

Attended the Workshop on Assessing Impact of fisheries on Biodiversity of Marine Fish Resources of Southwest coast of India' with all NWC associates at Mumbai RC, (19 - 21 February, 2007)- ***Dr.K.S. Mohamed, Dr. E.Vivekanandan & Dr.V.D.Deshmukh, Shri.M.Z.Khan, Shri.S.G.Raje, Dr.V.V.Singh, Dr.Miriam Paul, Smt.Paramita Banerjee, Dr.K.V.S.Nair and Dr.P.K.Asokan***

Participated in the International Training course on 'Strengthening Responsible Fisheries through Multi-Stakeholder Processes (MSPs) for the wise use of Ecosystems', Bohol Island, The Philippines, under the National Fellowship Programme of the Netherlands Government (14 - 26 June, 2006)- ***Dr.P. Laxmilatha and Dr.C.Ramachandran***

Participated in the Fifth Foundation Training Programme for Scientists and Technologists sponsored by the Department of Science and Technology, Government of India and held at Indian Institute of Public administration, New Delhi, (17 July - 6 October, 2006)- ***Shri. V. Venkatesan***

Final project consolidation meeting of Consultancy Project at Chennai(19-24 June 2006) - ***Dr. M. Rajagopalan, Dr. P.K. Krishnakumar, Dr. P. Kaladharan and Dr. K. Vijayakumaran***.

The highlights of the DOD project 'Studies on Marine Mammal of Indian EEZ and the Contiguous Seas' was presented to the Scientific Advisory Committee of DOD at Visakhapatnam (24-25th July 2006) - ***Dr. E. Vivekanandan***

Presented the highlights of work carried out by CMFRI in the third Annual Workshop of the ICAR Network Project on 'Impact adaptation and vulnerability of Indian Fisheries to Climate Change' at NDRI, Karnal (10-11th August 2006) - ***Dr. M. Rajagopalan, Dr. E. Vivekanandan and Dr. N.G.K. Pillai***

Attended the Awareness Building Workshop on 'National Agriculture Innovation Project' (NAIP) at CIBA, Chennai (19th August 2006) - ***Dr. M. Rajagopalan***

Attended the meeting of the Expert Group on Seaweed Cultivation and Utilization, Dept. of Science and Technology, New Delhi (12-13 September, 2006) - ***Dr. M. Rajagopalan***

First Meeting of the Expert Committee on Repositories of National Biodiversity Authority at Chennai (28th November, 2006) - ***Dr. M. Rajagopalan***

Seminar on "Right to information act – 2005" by the Chief Administrative Officer as follow up of the ICAR training at CIFE (Deemed University) (12th April 2006) - ***Dr. V.V. Singh***

Interactive meeting on "Guiding principles underlying the Draft National Policy for Farmers" at CIFW, Mumbai (10th July 2006) - ***Dr. V.V. Singh***

A Special lecture on "Ecosystem based modeling" at Fishery Resources Management Division of the CIFE, Deemed University, Mumbai (8th and 9th August 2006 - ***Dr. V.V. Singh***

Consultative Workshop on "Fisheries Education Policy: Issues and Challenges" at CIFE, Deemed University, Mumbai (7th February 2007) - ***Dr. V.V. Singh***

Hindi workshop on "Reproductive dynamics of penaeid prawns of Maharashtra" & "Marine biodiversity of India and challenges of its conservation" at Mumbai RC of CMFRI, Mumbai (30th March, 2007) - ***Dr. V.V. Singh***

National Training Workshop on Seaweed Farming and Processing for Food- 2006 at Kilakarai, organized by Krishanmurthy Institute of Algology, Chennai and TBAK College , Kilakarai (3- 5th August, 2006) - ***Dr. P. Kaladharan***

National seminar on Energy Conservation in Fisheries organized by the CIFT at Visakhapatnam (14th February,2007) - ***Dr. P. Kaladharan***

Regional Seminar on 'Blue Revolution' at Little Flower College, Guruvayoor , organized by the UGC., New Delhi (22nd to 24th February, 2007) - ***Dr. P. Kaladharan***

National Workshop on Impact, Adaptation and Vulnerability of Indian Agriculture to climate change organized under the ICAR network project at CMFRI., Kochi (19th to 21st March 2007) – ***Dr. M.Rajagopalan, Dr.E.Vivekanandan, Dr.N.G.K.Pillai, Dr.P.K.Krishnakumar and Dr. P. Kaladharan***

Delivered a radio talk on Sea cucumbers at the All India Radio, Thirunelveli (20th July, 2006) - ***Dr. P.S. Asha***.

Attended the Inter Media Publicity Coordination Committee Meeting at Divisional Railway Manager's Office, Thycaud, Trivandrum and presented CMFRI activities (26th March, 2006)-***Dr.R.Sathiadhas***

Attended the International Workshop on Evaluation of Capacity Building on Rural Resource Management (2nd Phase) in IARI, New Delhi organized by Michigan State University, USA sponsored by International Development Research Centre, Canada (11-15, April, 2006) - ***Dr. V.P. Vipinkumar.***

Participated in the National Workshop on Project entitled "Impact Assessment of Fisheries Research in India" at NAARM, Hyderabad (21st to 22nd April, 2006) - ***Dr.C. Ramachandran***

Participated and presented paper in Japan International Fisheries Research Society (JIFRS) for IIFET Biennial Conference 2006 at University of Portsmouth, UK (10-14th July, 2006) - ***Dr.C. Ramachandran***

Attended the State level Consultation Meet on Fisheries Development at Conference Hall of NABARD, Trivandrum (8th August,2006) - ***Dr.R.Sathiadhas***

Attended the Workshop organised by cooperatives and self help groups and led the Group Discussion at Loyola Hall, Kattoor, Alappuzha (19th August, 2006) - ***Dr.R. Sathiadhas***

Attended the IMPCC Meeting as per Directors nomination at Harmony Hall of Mascot Hotel, Trivandrum and presented extension activities of CMFRI (25th January, 2007) - ***Dr.R. Sathiadhas***

Attended the Trawl Ban Committee Meeting at Library Hall of IFP, Fine Arts Avenue, Kochi-16 (27th January, 2007) - ***Dr.R. Sathiadhas***

Attended the Pre- Budget Meeting convened by Dr.T.M. Thomas, Isaac, Finance Minister, Govt. of Kerala at Rama Varma Club, Cochin (3rd February, 2007) - ***Dr.R. Sathiadhas***

Attended the National Seminar on "Information and Communication Technology: Opportunities & Challenges for Revitalizing Extension System" at Navsari Agricultural University, Gujarat and presented the paper entitled 'Impact of awareness programmes, movies, website and infrastructure facilities of ATICof CMFRI : An Assessment'(27th to 29th December, 2006) – ***Dr. V.P. Vipinkumar.***

Attended the fourth sitting of Trawl Ban Committee meeting at Library Hall of IFP, Fine Arts Avenue, Kochi-16 (9th February, 2007) – ***Dr. N.G.K. Pillai, Dr.R. Sathiadhas, Dr.E.V.Radhakrishnan and Dr.M.Srinath***

Attended the first sitting of the committee to study the impact of Indo -Thailand free trade agreement convened by the Secretary of Fisheries , Government of Kerala at Kochi (26th March, 2007) - ***Dr.R. Sathiadhas***

Attended a four week GIS training at NRSA, Hyderabad (3rd to 28th, April 2006) - ***Smt. Sujitha Thomas***

Attended an Awareness Building Satellite Workshop at CMFRI, Cochin (16th September, 2006) -***Dr. Rani Mary George***

Attended a workshop on 'Biogeographic Information system for Indian ocean' at NIO Regional Centre, Cochin (25th and 26th September, 2006) - ***Dr. Rani Mary George, Smt. Rekha J. Nair and Smt. Sandhya Sukumaran***

Attended the National Workshop on Marine Biodiversity Data Management & Digitization of Museum Specimens held at NIO, Goa (15-16 January, 2007) - ***Smt. Rekha J. Nair***

Attended a workshop for the officials of Indian Coast Guard organized by MOEF and presented a lecture on Marine plant and animal diversity (18th January, 2007) - ***Dr. Rani Mary George***

Attended the Zonal Workshop on 'Skill enhancement workshop on marine fisheries data collection' conducted by FRAD for the field staff belonging to FRA Division engaged in resource data collection (16-18 April 2007) - ***Smt. Rekha J. Nair and Smt.Rekha Devi Chakraborty***

Attended a workshop on 'Trophic modelling and ecosystem analysis' conducted by Demersal Fishery Division as a part of the Diamond Jubilee year (26-28 April, 2007) - ***Dr. Rani Mary George, Dr. K. Vinod, Smt. T.S. Naomi and Shri N.K. Sanil***

Attended the DBT Task Force meeting on at Department of Biotechnology, New Delhi (4th September, 2006) - ***Dr. K.K. Vijayan***

Participated as a Technical expert in the II PCR NACA –Training workshop at Chennai from 23-26 October 2006 and the project coordination meeting at Mangalore (28-29th October, 2006) - ***Dr. K.K. Vijayan***

Attended the meeting on Marine Biotechnology for developing a collaborative project with NIOT & CMFRI at National Institute of Ocean Technology, Chennai (2nd December, 2006) - ***Dr. K.K. Vijayan***

Attended the Evaluation meeting to discuss issues on efficacy, toxicity and environmental safety with reference to the project on "Control of White Spot Syndrome Virus (WSSV) of shrimp in the culture system by Nanoparticles/modified nanosystem" at Delhi conducted by Biotechnology Consortium India Limited (16-17 January 2007) - ***Dr. K.K. Vijayan***

Attended the Network project meeting on 'Application of microorganisms in agriculture and Allied Sectors' convened by DDG (Fy) at NAAS, New Delhi (26-27 February 2007)- ***Dr. K.K. Vijayan and Dr. Imelda Jopseph***

Attended a meeting of the Scientists in ICAR Fisheries Research Institutes and a panel of experts held under the Chairmanship of Dr. S. Ayyappan, Deputy Director General (Fisheries), ICAR at NRCCWF, Bhimtal (22-23, September 2006) - ***Dr. K.K. Vijayan, Dr. P.C. Thomas and Dr. P. Jaysankar***

Meeting of the Working Group on Fisheries and Fisheries Research at State Fisheries Department Chennai (14th November, 2006) - ***Shri.D. Kandasami***

State level Committee Meeting of Gulf of Mannar Biosphere Reserve Trust at E & F Secretariat Chennai (19th December, 2006) - ***Shri.D. Kandasami***

Workshop on Stakeholders Appraisal of Vital Missing Links in Coastal Aquaculture Development (10th -11th August, 2006) - ***Shri.D. Kandasami***

Participated in one day Workshop on "Participatory management and conservation of lobster resources along Indian Coast" held at Kasimedu, Chennai (6th March, 2007) - ***Dr. E.V.Radhakrishnan, Dr.H.M. Kasim, Dr.Krishna Srinath, Shri. D. Kandasami, Smt. S.Lakshmi Pillai, Shri. Joe K. Kizhakudan, Smt. Shoba Joe. Kizhakudan, Dr.Margret Muthu Retnam and Shri. Wilson T.Mathew***

Euro Asia Pro Eco Programme at the Department of Environmental Health Engineering, SRMC&RI Chennai (25th December, 2006 and 13-16 March, 2007) - ***Shri.D. Kandasami***

Attended the Second Sub-Committee Meeting of Parliamentary Committee on official Langiage at Cochin (12 October, 2006 and at Veraval (12-15 February, 2007) - ***Dr. E.V.Radhakrishnan***

Participated in the workshop on "Responsible Fisheries- Strategies and Practices" held at Anna University. Chennai (26-27 March, 2007) - ***Shri.D. Kandasami***

Made a presentation on "Application of AFLP markers to detect genetic variation" at a training on "DNA Marker Technologies, Principles and Applications" organized by NBFGR, Cochin Unit (26th February, 2007) - ***Dr. P. Jayasankar***

Made a presentation on "Recent trends in DNA-based conservation efforts of marine mammals" at a training on "DNA Marker Technologies, Principles and Applications" organized by NBFGR, Cochin Unit (1st March, 2007) - ***Dr. P. Jayasankar***

Participated in the Meeting on "Networking in Fisheries Nutrition" convened by DDG(Fy) at Central Institute of Freshwater Aquaculture (CIFA), Kausalyaganga, Bhubaneswar 8th April, 2006. ***Dr. R. Paul Raj, Dr. Imelda Joseph and Dr. P. Vijayagopal***

Meeting in "Seed production in agricultural crops" convened by DDG (Fy) at Central Institute of Freshwater Aquaculture (CIFA), Kausalyaganga, Bhubaneswar (6th April 2006 to 7th April, 2006) - ***Dr. R. Paul Raj and Dr. Imelda Joseph***

First review meeting of AMAAS (Application of Microorganisms in Agriculture and Allied Sectors) Project of ICAR at National Bureau of Agriculturally Important Microorganisms (NBAIM, Coordinating Center) Mau. - ***Dr. Imelda Joseph***

Meeting convened by DDG (Fy.) at NAAS, New Delhi for new concepts for AMAAS (Application of Microorganisms in Agriculture and Allied Sectors) Network project of ICAR (27th February, 2007) - ***Dr. Imelda Joseph***

Attended Winter School on " Seafood Quality Assurance-current issues and problems" held during at College of Fisheries, Tuticorin (1st – 21st November, 2006) - ***Dr. Margaret Muthu Rethnam***

Participated in the workshop "Stake holder's appraisal of vital missing links in coastal aquaculture development held at CIBA, Chennai (10th & 11th August, 2006)– ***Smt. S. Lakshmi Pillai***

Attended Seminar on 'Contribution of Science and Technology in the development of Kerala' at CUSAT, Kochi (19-20, December 2006)- ***Dr.E.V.Radhakrishnan***

Attended the All India Aquarium Show, Matsyalankar 2007 at Calicut as Chairman of the Judging Committee of various competitions of the show (5th January, 2007) – ***Dr.E.V.Radhakrishnan***

Attended the Seminar on "Sea foods" in District Industries Centre, Ramnad (14th February, 2007) – ***Dr. M. Rajamani***

Attended National workshop on Coastal zone management plan organized by MICTRA, Calicut at Hotel Renaissance, Kozhikode (29th July, 2006) – ***Dr. K.K.Philipose***

Attended UGC sponsored National conference on Aqua ornamentals organized by the PG department of Zoology, S.N.College, Nattika, Trichur district, Kerala (18th to 19th September, 2006)– ***Dr. K.K.Philipose***

Attended the workshop on brackish water fish farming organized by Brackish Water Fish Farmers Development Agency (BFFDA), Department of fisheries, Government of Kerala, at Community hall, Chemenchery, Kozhikode (22nd November,2006) – ***Dr. K.K.Philipose***

Attended the All India Aquarium Show, Matsyalankar 2007 at Calicut as Technical Advisor of the show (5th January, 2007) – ***Dr. K.K.Philipose***

Participated in the training programme on Ornamental fish culture organized by the Water shed management division, Department of agriculture, Government of Kerala at Nalanda auditorium,Kozhikode and gave a lecture on ornamental fish culture (17th March 2007) – ***Dr. K.K.Philipose***

Participated in the training programme on ornamental fish culture organized by the Fresh Water Fish Farmers Development Agency, Department of Fisheries, Kozhikode on at the FFDA training centre Kozhikode (19th March, 2007) – ***Dr. K.K.Philipose***

Participated in Seminar "Hygienic handling of catch for better preservation conducted by MPEDA and presented paper "Recent changes in species composition in shrimp landing along Mangalore coast demand new methods for shrimp handling for quality improvement (12th September, 2006) – ***Dr. A. P. Dinesh Babu***

Attended the Awareness Campaign on Harvest and Post-harvest Technologies conducted by the Regional Centre, CIFT, Visakhapatnam at Fishing Harbour, Visakhapatnam (25th January, 2007) – ***Dr. G. Maheswarudu and Dr. K.K.Philipose***

Participated in the Workshop on the ICAR Network Project "Climate change and Marine Fisheries" in NDRI, Karnal on August 9&10, 2006; and in CMFRI, Kochi (19th -21st March, 2007) – ***Dr. E. Vivekanandan***

Participated in the CMLRE Workshop presentation on Marine Mammals at Visakhapatnam (25th July, 2006) – ***Dr. E. Vivekanandan***

Participated in the Workshp on NAIP Projects at CMFRI, Cochin (10th November, 2006) – ***Dr. E. Vivekanandan, Dr.N.G.K.Pillai, Dr.E.V.Radhakrishnan, Dr.R.Sathiadhas, Dr.K.S. Mohamed, Dr. Rani mary George, Dr. M.Srinath and Dr. G.Gopakumar***

Attended the "Workshop on strengthening of data collection and fish taxonomy" organized by the Fishery Survey of India, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Mumbai held at the Geological Survey of India, Mangalore (3rd August, 2006)– ***Dr.C.Muthiah***

Attended the fourth Meeting of the Committee for sorting out the gaps in the marine fish landings estimates computed by States and CMFRI, held at Geological Survey of India., Mangalore (4th August, 2006) – ***Dr.C.Muthiah***

Attended the meeting of the Town Official language Implementation Committee, Mangalore held at the Corporation Bank Headquarters, Mangalore (13th May, 2006 and 22nd December, 2006) - ***Dr.C.Muthiah***

Attended the meeting of the Committee of Parliament on Official Language held at Mangalore (27th April, 2006) - ***Dr.C.Muthiah***

Attended the Winter School on "Andragogic methodologies of Educational Technology vis-a- vis the Emerging ODL Programmes" at the Department of Agricultural Extension and Rural Sociology, Tamilnadu Agricultural University, Coimbatore 25th January, 2006 to 14th February, 2006. –***Dr.P.S.Swathi Lekshmi***

Attended the Winter School on "Computer –based Multimedia Presentation at the National Academy of Agricultural Research Management, Rajendranagar, Hyderabad (16th February, 2006 to 8th March, 2006) –***Dr.P.S.Swathi Lekshmi***

Attended the computer training conducted under the HRD Programme at CMFRI Headquarters, Kochi, on data base management using MS Access and Web designing using MS Front Page /Macromedia Dream Weaver (February 2007) – ***Dr. A.P. Dinesh Babu, Dr. K.Vijayakumaran, Smt. Geetha Sasikumar, Dr. P.K. Asokan, Dr. Gulshad Mohamed, Dr.A.P. Dinesh Babu and Smt. P.T. Sarada***

Attended the one month course in "Introduction to GIS and its Application" conducted by National Remote Sensing Agency, Hyderabad (3rd April, 2006 to 28th April, 2006) - ***Smt. Sujitha Thomas***

Attended the Training Programme on "DNA Marker Technologies, Principles and Applications at National Bureau of Fish Genetic Resources (NBFGR), Kochi (21st February, 2007 – 3rd March, 2007) - ***Smt. Sujitha Thomas***

Attended the TOLIC meeting organized by the Town Official Language implementation committee at Trivandrum (19th October, 2006) – ***Dr. Grace Mathew***

Participated in the Inter Media Publicity Committee meeting held at Doordarshan Kendra, Trivandrum (29th November, 2006) -***Ms. S. Jasmine***

Attended Winter School on "Inland Fisheries Management using GIS tools" organized by CIFRI, Barrackpore (14th November – 4th December, 2006) – ***Dr. Shubhadeep Ghosh***

Attended a training programme on Ecopath Trophic Modeling and Simulation held at Mumbai Centre of CMFRI from (19th – 22nd February, 2007 – ***Dr. P.K. Asokan***

Attended the Scientific Advisory Committee Meeting of the KVK of Kerala Agricultural University at Trichur (27th March, 2007) -***Dr. K. Asokakumaran Unnithan***

Attended the TOLIC meeting held on held at Canara Bank. Tuticorin (29th June, 2006) - ***Dr.K.K. Joshi***

Technical staff of the Institute participated in the following training programmes

Training on Preservation of zoological specimen at Govt. Museum, Chennai (1-15 June 2006) - ***Smt. P.M. Geetha***

Training on Preservation of zoological specimen at Govt. Museum, Chennai (1-15 June 2006) - ***Smt. K.P. Salini***

Training on Spawn production and cultivation of medicinal mushroom at NRCM, Solan (17-19 July 2006) - ***Shri B. Sureshkumar***

Training on Aquarium management and ornamental fish culture at CIFE, Mumbai (11-20 August 2006) - ***Shri.J. Narayanaswamy***

Training on Recent advances in Civil Engineering at CUSAT, Kochi (3 - 4 December 2006**) - *Shri N. Viswanathan***

Training course on mass production Technology of biological control agents at National Centre for Integrated Pest Management, New Delhi (14 -23 February 2007**) - *Dr. B. Sureshkumar***

Training on subject matter specialists at Kerala Agriculture University, Thrissur (12-13 March 2007) - ***Smt. Sreelatha***

Administrative staff of the Institute participated in the following training programmes

Training on Right to Information Act at NAARM, Hyderabad (25-26 April, 2006) - ***Shri K.L. Meena***

Training on Advance management programme in Building winning organizations for the world of tomorrow at MDI, Gurgon (21 August 2006 -7 September 2006) - ***Shri G.P. Sharma***

Training on Video Production & Management at NAARM, Hyderabad (12-23 December 2006) - ***Ms. Manjusha. G. Menon***

Training. programme on competency management at ISTM, New Delhi (3-5 January 2007) - ***Shri K.L. Meena***

Training programme on leadership and organization development at at ISTM, New Delhi (8-12 January 2007) - ***Shri G. P. Sharma***

Workshops Seminars and Training Programmes Organised

The details of mabe pearl formation being explained to Kollam District Collector

A mussel farmer with his harvest

Training in Stock Assessment methods

Conducted one week training programme on Fish stock assessment and Estimation of Fishery resources, from 11th September 2006 to 16th September 2006 at Cochin. Officials from Karnataka state fisheries department participated in the training program.

Conducted training programme on Stock Assessment Methods for Marine Fisheries Management during 16-30th October 2006.

Computer training programmes under HRD programme in two batches were organized at the division for Scientific, technical and administrative staff of the institute from headquarters/regional/research centres. First batch of training was organized from 12 –27 February, 2007 and the second was from 1-17 March, 2007. The topic covered in the training programme are database management using MS Access, Web designing using MS Front page/macro-media-dreamweaver and report generation with enhanced graphics and other embedded features using Adobe Photoshop and Corel Draw

A training progoramme on Software and methodology in sampling design, collection and data collection and analysis for FSI staff were conducted from 5th to 9th March, 2007 at CMFRI. Six staff from FSI participated the training programme

Training in Mariculture

Front line demonstrations and training for trainers / farmers in mariculture technologies

Mabe pearl production

The mabe pearl culture technology which was developed during last two years was transferred to one Self Help Group. Five families were trained in mabe implantation and base image preparation. Project proposals were submitted to different development offices in Kerala and Tamilnadu.

Collaboration with ICAR RC Goa. Two mussel farms were set by at Zuari estuary and a shrimp pond in Goa. Several farmers and staff of the Research Institute were trained in new methods of mussel farming. The mussels have reached 70 mm length in three months indicating good growth and high survival.

Interaction and evaluation

As part of the Institution effort to conserve the marine turtle resources, Calicut Research Centre of CMFRI has taken up rearing of turtle eggs collected by the fishermen community of the West Hill Region. A make shift hatchery for turtle eggs was established in the beach farm with the help of the Forest Department. Ninety seven eggs were hatched in the hatchery and the young ones were released to the sea on 4th February by Shri Benoy Viswam, honorable minister for Forest and wildlife Govt. of Kerala in presence of all the scientists and technical officers of the centre, Forest Department officials and local public.

Training programmes in bivalve mariculture

Location	Topic	Participants		Organiser
		Men	Women	
Kollam	Mabe pearl production	5	10	BFFDA
Thankasserry (Kollam Dt.)	Mussel seeder demonstration	6		BFFDA
Kakkamadanthuruth (Ernakulam Dt.)	Mussel & Oyster farming	6	15	BFFDA
Chavara (Kollam Dt.)	Mussel & Oyster farming	9	45	BFFDA
Cherai (Ernakulam Dt.)	Mussel & Oyster farming	7	32	BFFDA
Puthenvelikkara (Ernakulam Dt.)	Mussel & Oyster farming	10	68	BFFDA
Alappat (Kollam Dt.)	Mussel farming		82	TEAP
Elamkunnapuzha (Ernakulam Dt.)	Mussel farming		30	TEAP
Vadakkekkara (Ernakulam Dt.)	Mussel farming		32	TEAP
Cherai (Ernakulam Dt.)	Mussel seeding demonstration	2	18	BFFDA
Thekkumbhagom (Kollam Dt.)	Mussel farming		74	TEAP
Valiyapanikkanthuruth (Trichur Dt)	Mussel farming	15		RGCCS
Valiyapanikkanthuruth (Trichur Dt)	Mussel farming	15		RGCCS
Valiyapanikkanthuruth (Trichur Dt)	Oyster farming	15		RGCCS

A fishermen meet of 40 participants was held on 12th January at KVK campus, which discussed the topic '*Marine environment, fishery resources and their conservation along the Kerala Coast*' under the leadership of Dr. C. Ramachandran, Senior Scientist.

A General Awareness programme was held for 25 women of the Micro finance group at Udayamperoor in Ernakulam District on 7th February and discussed training and other extension programmes organized by the KVK for rural women empowerment.

A harvest mela of mussels farmed by one of the beneficiary groups, facilitated by the Mariculture and Molluscan Fisheries Divisions and the KVK, was arranged on 15th March at Narakkal. Sale of harvested mussels was inaugurated by Smt. Philomina Antony, President, Narakkal Panchayat and 50 people including fishermen, farmers, scientists and representatives of local administration participated in the function.

Workshop on 'Participatory management and conservation of lobster resources along the Indian coast' held at Chennai

A one day workshop on 'Participatory management and conservation of lobster resources along the Indian coast' with special emphasis on Tamil

Nadu was held on 6th March at Export Fish Landing Centre, Kasimedu, Chennai as part of a Stakeholder's meet under the MPEDA funded project 'Participatory management and conservation of lobster resources along the Indian coast'. The workshop was attended by leaders of Fishermen Association and Co-operatives, NGOs, State Fisheries Department, traders, exporters and other Central Government agencies and Fisheries College staff and students.

The main theme of the workshop was sustainable management and conservation of lobster resources of Tamil Nadu. The workshop was inaugurated by Sri. K.P.P. Samy, Honourable Minister for Fisheries, Tamil Nadu. Prof. S. Kannaiyan, Chairman, National Biodiversity Authority of India, Chennai, Dr. A. G. Ponniah, Director, CIBA, Prof. (Dr.) Mohan Joseph Modayil, Director, CMFRI, Dr. E.V. Radhakrishnan, Head, Crustacean Fisheries Division and Principal Investigator, Dr. H.M. Kasim, Scientist-in-Charge, Madras Research Centre, Dr. B. Meenakumari, Shri. Joe K. Kizhakudan and all staff members of the Madras Research Centre were present. Logos, posters and pamphlets on lobster conservation released by the Minister and the dignitaries during the workshop were distributed to the fishermen and other stakeholders. Seminars on relevant topics on lobsters were also conducted. The fishermen voluntarily took pledges on conservation of the resource.

Workshop on "Responsible Fisheries- Strategies and Practices"

Inaugural function of the workshop on 'Responsible Fisheries- Strategies and Practices'

A workshop was organized by the Madras Research centre on "Responsible Fisheries- Strategies and Practices" at Anna University, Chennai from 26th to 27th March. It was inaugurated by Dr. N. Balaraman, Vice Chancellor, Tamil Nadu Veterinary and Animal Sciences University and Dr P.S.B.R. James, Former Director of CMFRI presided over the Inaugural Session. Dr. H. Mohamad Kasim, Scientist in charge, C.M.F.R.I., welcomed the gathering. Dr Y.S. Yadava, Director, Bay of Bengal Programme, Chennai delivered the special address. Dr. V.K. Venkataramani, Dean, College of Fisheries, Tuticorin and Dr. M.K. Mukundan, Head, Quality Assurance and Management Division, CIFT, Cochin, offered felicitations. Dr. Krishna Srinath, Principal Scientist (Workshop Convener) proposed vote of thanks.

Lead lectures on key topics were delivered by eminent personalities dealing with different aspects of Responsible Fisheries. An interactive session for field level workers and fishing community was also held in which about 50 fishermen from fishing villages in Chennai participated.

The valedictory session was attended by Prof. L. Kannan, Vice Chancellor, Tiruvalluvar University, Dr. M. Devaraj, Dr. N.G.K. Pillai, Shri. Joe K. Kizhakudan and Dr. D. Kandasami, among other scientific personnel.

Sri. A. K. Upadhyay IAS, Secretary, ICAR releasing the Diamond Jubilee Emblem during the inaugural function

Foundation Day and Diamond Jubilee year celebrations

Foundation Day and beginning of the Diamond Jubilee year were celebrated on 3rd February. The Open House exhibitions by divisions were witnessed by a large number of students from several schools and colleges in Kerala. Prof. Dr. R.N. Sreenivasa Gowda, Vice Chancellor, Karnataka Veteri-nary, Animal and Fisheries Sciences University, Bidar inaugurated the celebrations in presence of Shri. A.K. Upadhyaya, Additional Secretary (DARE) & Secretary, ICAR. In the cultural evening staff and their family members had exhibited their artistic and cultural skills.

Foundation Day celebration at KVK

On 3rd February, 125 participants including Panchayat President, Panchayat members, representatives from different State Departments, farmers, fishermen and farm labours visited the KVK Centre at Narakkal and observed the activities of the centre.

National Seminar

A National Seminar on 'Enhancing Skills for Research and Development in Marine Fisheries' was organized by the Institute during 5th-7th February at Cochin as part of Diamond Jubilee Year of CMFRI. Dr. A.E. Muthunayagam, Former Secretary, DOD, Govt. of India & Executive Vice President, KSCST & E, Govt. of Kerala was the Chief Guest. Former Directors of CMFRI, Dr. E.G. Silas, Dr. P.S.B.R. James, and Dr. V.N. Pillai offered felicitations. Dr. Mohan Joseph Modayil, Director, CMFRI, presided over the function.

Dr. E.G. Silas, Shri. Sebastian Mathew, Shri. M.K.R. Nair, Dr. V.S.R. Murthy, Dr. T. C. Santiago, Dr. S. Santhanakrishnan, Dr. D. Chandra Mohan, Shri. PL. Kumaran, Shri. Kuruvilla Thomas, Dr. P.S.B.R. James, Shri. V. Vivekanandan, and Dr. Anil Rai spoke on different topics of fisheries, biology, management, marketing, social issues and conservation.

Dr. A.E. Muthunayagam, Former Secretary, DOD inaugurating the National Seminar at Cochin

Workshop on climate change organized

Dr. M. Rajagopalan, Head, FEMD organized a workshop on the ICAR Network Project on "Impact, Adaptation and Vulnerability of the Indian marine fisheries to Climate Change" during 19th to 21st March at CMFRI, Cochin. In this Workshop 12 ICAR institutes & SAUs presented the final project reports of X Plan. Twenty five ICAR institutes & SAUs presented the new proposals for Climate Change Project to be implemented during XI plan period under ICAR network Project of NRM Division.

Inaugural function of the Workshop on climate change at CMFRI, Cochin

Diamond jubilee celebrations from regional and research centres

At Madras Research Centre, exhibition on the various activities of this centre was arranged on 3rd February. A large number of students and staff from the local schools and colleges as well as public visited the exhibition.

At Mangalore Research Centre, a scientific interaction meeting was held on 28th February, wherein Dr. A.C. Dinesh, Senior Geologist, Geological Survey of India delivered a special talk on the nature and causes for the occurrence of Tsunami.

At Visakhapatnam Regional Centre, an open house was organised for the public on 3rd February. The inaugural function was attended by Dr. C. Babu, Chairman, Suvarna Rekha Marine exports, Visakhaptnam , Dr. K.R. Prasad, President, Forum of Fisheries Professionals of India, Visakhapatnam and Dr. G. Syda Rao, Scientist-in-Charge, in addition to several retired scientists from CMFRI, CIFT, officials from other fisheries research organizations and all the staff members from CMFRI and CIFT.

In the open house charts, models and live aquarium exhibits were arranged. The Hatchery was opened for the public on that day. The research activities carried out by the center were explained to the visitors by the staff members of the center. Officials from various fisheries department/institutions, students from schools and colleges, fishermen and other entrepreneurs visited the Center.

Personnel
(Senior positions only)

Director	**Prof. (Dr.) Mohan Joseph Modayil**
Heads of Divisions	
Heads of Divisions	
Fishery Resources Assessment Division	Dr. M. Srinath
Pelagic Fisheries Division	Dr. N. Gopalakrishna Pillai
Demersal Fisheries Division	Dr. E. Vivekanandan
Crustacean Fisheries Division	Dr. E.V. Radhakrishnan
Molluscan Fisheries Division	Dr. K.Sunilkumar Mohamed
Fishery Environment Management Division	Dr. M. Rajagopalan
Phisiology, Nutrition and Pathology Division	Dr. K.K. Vijayan
Socio-Economic Evaluation & Technology Transfer Division	Dr. R. Sathiadhas
Marine Biodiversity Division	Dr. (Mrs.) Rani Mary George
Mariculture Division	Dr. G. Gopakumar
Sr. Administrative Officer	Shri. K. L. Meena
Sr. Finance & Accounts Officer	Shri. G. P. Sharma
Administrative Officer	Shri. N. Viswambharan
Scientists-in-Charge of Regional/Research Centres	
Mandapam Camp	Dr. N. Kaliaperumal, PS
Chennai	Dr. H. Mohamed Kasim, PS
Tuticorin	Dr. A.C.C. Victor, PS
Karwar	Dr. V.S. Kakati, PS
Mangalore	Dr. C. Muthiah, PS
Veraval	Dr. K.V. Somasekharan Nair, PS
Vizhinjam	Smt. Grace Mathew, PS
Mumbai	Dr.V.D. Deshmukh, PS
Visakhapatnam	Dr. G. Syda Rao, PS
Calicut	Dr. P.N. Radhakrishnan Nair, PS
Krishi Vigyan Kendra, Narakkal	Dr. Asok Kumaran Unnithan, Sr. Scientist

Official Language Implementation Activities for the year 2006-2007

A gist of Implementation activities of the year is given below.

I. Policywise ensurance

a) Correspondence and bilingualisation programmes to run the machinery in Hindi.

By fixing check points at various levels and initiating action plans staff were enabled and encouraged to work themselves in Hindi. Infact the Institute for the first time was able to cover all the targets on Hindi correspondence viz by issuing all the Section 3(3) documents (345) in bilingual; replying in Hindi itself of 435 letters received in Hindi; sending 61% Hindi letters to A,B,C region; ensuring bilingual use of stationery items by adding 43 rubber stamps, 24 name plates/letter heads, 760 charts/labels, 8 plaques/banners etc.

b) The Official Language Implementation Committee meetings and review of Quarterly progress reports:

In order to chalkout action plans and watch the progress 4 meetings of the Official Language Implementation Committee organized. The performance of 10 outstations were reviewed through the Quarterly Progress Reports and suggestions were given for improvement.

c) Inspections by the Institute and for the Institute

By covering the 25% target the Director, CMFRI has inspected 4 Centres and the suggestions given were policywise monitored. The Committee of Parliament on OL has inspected the Hindi implementation activities of Mangalore Research Centre on 27-4-2006; Kochi on 12-10-2006 & Veraval Reg.Centre on 14-2-2007 to assure & implement the OL policy in the Institute.

Inspection meeting of the Committee of Parliament on Official Language held at the Manglaore R.C. of CMFRI

II. HRD/Education/Extension programmes for promotion

a) HRD/Education: By the maintenance of rosters on working knowledge and deputation 8 employees passed various courses under Hindi Teaching Scheme. 2 Hindi workshops at Kochi and 3 at Centres were organized wherein 66 employees were trained. Under the scheme *learn a word a day* 286 Hindi/ English words displayed. With a view to link Hindi in higher education abstracts of 4 MFSc and 2 Phd thesis were translated.

b) Extension : Hindi chetana maas was observed by conducting programmes on concepts like terminology development; e-governance; transfer of technologies etc. Notable contributors of the year and winners of various competitions were promoted by awarding cash incentives and prizes.

View of inspection meeting of the Committee of Parliament on Official Language held at Kochi on 12.10.2006

c) Library services: 50% of the Library grant has been spent for the purchase of Hindi books other than standard reference books and periodicals. 63 Senior Officers have been provided with reference books. Library services have been extended to all members of staff.

III. The Press and Editorial for use and spread of language

During the year the following bilingual / Hindi publications were released.

- Marine Fisheries Information Service nos. 186-189 – Bilingual
- CMFRI News letter nos. 109 to 112 – Bilingual
- *Matsyagandha 2005* - 6th in the series - Hindi.
- Annual Report 2006 with Hindi executive summary.

CMFRI won the Cochin TOLIC Rajbhasha Rolling Trophy (Ist position) for the best implementation of Official Language for the year 2005-2006

The CMFRI special publication Matsyagandha won the *Ganesh Sankar Vidyarthi Award* of ICAR for the year 2004-2005.

Dr. E. V. Radhakrishnan, Scientist-in-charge, Official Language Implementation Cell receiving the *Ganesh Sankar Vidyarthi Award* from Shri. A. K. Upadhyay IAS, Secreatary, ICAR at New Delhi

IV. E-governance programmes to speed up

In order to access Hindi with speed the following programme were introduced.

a. Online display of the programmes *word of the day*

b. Dak and Dispatch software *Avagaman* to track data base on correspondence.

c. Updation of web www.cmfri/hindi

Distinguished Visitors

Guests

Headquarters, Cochin

- Dr. Mohamed Najib Bakeer, Central Lab. of Aquaculture Research (CLAR), Egypt.
- Dr. C.V. Raju and S.R. Somashekar, College of Fisheries, Mangalore.
- Shri. A.K. Upadhyay, IAS, Additional Secretary, DARE & Secretary, ICAR.
- Prof. (Dr) R. N. Sreenivas Gowda, Vice-Chancellor, Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar.

Veraval Regional Centre

- Shri Julian P. Mchodo, Asst. General Manager, District Development, Junagadh, NABARD, Amreli & UP of Diu.

Mandapam Regional Centre

- 1823 visitors to Museum, Aquarium including 845 students from 48 Schools/Colleges.
- Dr.S.A.H.Abidi, Former Member, ASRB, CM-II Sector B Alighant, Lucknow. Dr.M.Sakthivel, Aquaculture Foundation of India, Chennai.
- Dr. C. D. Mayee, Chairman, ASRB, New Delhi.

Visakhapatnam Regional Centre

- Students and faculty from different colleges.
- Dr.Anchana Waren, Project Officer, WWF-India, Hyderabad.
- Dr. S.A.H. Abidi, Chairman, DOD Review Committee.
- Dr. R. Ravindranath, Advisor, DOD.
- Prof. (Dr.) N.R.Menon, CUSAT, Cochin.
- Dr.M.Sakthivel, President, Aquaculture Foundation of India.
- Thirty fishermen and women members VSS members of 3 North Coastal A.P. district.

Mangalore Research Centre

- Smt. Veena Gadiyar, Manager, Canara Bank, Balmatta, Mangalore.
- Smt. Maya S., Manager (Official Language), Vijaya Bank Regional Office Jyothi Circle, Mangalore.
- Smt. Chaya Moorthi, Manager (Official Language), Syndicate Bank, Balmatta, Mangalore.
- Smt. Binu S., Officer (Official Language), Corporation Bank Head Office, Pandeshwar, Mangalore.
- Shri.K.V. Basavakumar, Associate Professor (Fisheries), Directorate of Research, University of Agricultural Sciences, Dharward.
- Dr.Mridula Mendon, Assistant Professor, College of Fisheries, Mangalore along with the students of Fisheries college, Mangalore.
- Students and faculty from various Colleges.

Chennai Research Centre

- Students and faculty from various colleges.
- Shri. A.K. Upadhyay, IAS, Additional Secretary, DARE & Secretary, ICAR.

Tuticorin Research Centre

- Commandant S.M.Singh, Commanding Officer, I C G S. Naiki Devi, Tuticorin.
- Dr. Safeena, A.N., Director, Bihar Urban Develoment Agency & Joint Secretary, & Observer, Tamil Nadu Assembly Elections, Urban Development Department, Bihar.
- Mrs. Uma Shankar, Scientitific Officer, NZOSP, NFC, Hyderabad.
- Mr. Mudit Agarwal, Scientific Officer, NZOSP, Pazhayakayal, Tuticorin.
- Dr.Nguyen Van Twa, College of Aquaculture & Fisheries, Cauthew University,

Vietnam

- Dr. I. K. Sivadas, Visiting Professor, CUSAT, Lake side campus, Cochin.
- Pro.R.Damodaran, (Rtd), CUSAT, Lake side campus, Cochin.
- Dr.K.K.C.Nair, Former SIC of NIO, Kochi.
- Shri.S. Manoharan, Rural Development Specialist, World Bank.
- Students and faculty from various colleges.
- Mr. Umeshkumar, Inspector General /South , CISF, Chennai.
- Dr. R.K. Majumdar, Asst.Professor, College of Fisheries, Agartala, Tripura.
- Shri. A. K. Upadhay, IAS. Additional Secretary, DARE & Secretary, ICAR.
- Dr. P.Paul Pandian, Dy. Advisor (Fy), Planning Commission, Govt. of India, New Delhi.

Vizhinjam Research Centre

- George Mercier, MLA (Thiruvananthapuram).
- Shri R.S. Bhandari, Senior Principal Private Secretary to Secretary, DARE, ICAR, New Delhi.
- 19,652 persons including college and school students visited the Marine Aquarium. and revenue of Rs. 3,23,720/- was generated as entry fee.

Calicut Research Centre

- Prof. B.D. Shelke, Horticulturist, Raj Bhavan Adrasha Colony, Akola.
- Dr. Sanjay Dhotre, M.P. Lok Sabha, Akola (M.S), Ranpise Nagar, Akola.
- Dr.N.K. Tyagi, ASRB Member, New Delhi.

- Shri R.S. Shukla, Chief conservator of forestry (Northern Region), Kozhikode.

Mumbai Research Centre

- Dr. Aniruddha D.Adsul and Dr. D.I. Pathan, Assistant Professors and students, College of Fisheries, Ratnagiri and, Asst. Professor(Aquaculture), College of Fisheries, Ratnagiri.

Karwar Research Centre

- Dr. (Smt) Rama Naik Principal, and students of Kamat English Medium School.

Minicoy Research Centre

- Shri. O.G. Hassan, Plant protection Assistant AD unit Minicoy along with 20 Agricultural trainees.
- Rtn. PHF. K.S. Pillai, District Governor Rotary International, Dist. 3200, Mrs.Pillai, Secretary, President and members of the Minicoy Rotary.
- Shri. A.S.Alagarswamy ,Senior Manager ,Syndicate Bank ,Chennai.
- Mr. Alexander Jacob, Scientist, AVT. Mc Cosmic, Trivandrum.
- Commander .J.I.Mohindru, Command Aviation Officer, HQ SNC, Naval Base, Kochi.
- Dr. C. Thamban, Sr. Scientist, Dr. T. Vidhan Singh, Sr. scientist and Shri. Hareesh G.S.,Technical Assistant, CPCRI, Kasaragod.
- Mr. Azeez and Mr. K.A. Parameshwaran, ECIL,Tatapuram, Ernakulam.
- Mr. N. Moorthy and Mr. V.S. Vijay Raj, ECIL,Hyderabad.
- Shri. Kuldeep Bahadur, C-32, Sector -41, NOIDA, New Delhi.
- Dr. P.P. Koya Hon'ble Member of Parliament and the team.

कार्यकारी सारांश

वर्ष 2006-2007 के दौरान सी एम एफ आर आइ ने 14 विभागीय, 13 अन्तर्विभागीय, 1 अंतरसंस्थानीय, 18 प्रायोजित और 4 परामर्श परियोजनाएं कार्यान्वित कीं। इन परियोजनाओं का लक्ष्य समुद्री संपदाओं का टिकाऊ विकास सुनिश्चित करना, समुद्री संवर्धन प्रौद्योगिकियों से उत्पादन बढ़ाना और समुद्री जैवविविधता का परिरक्षण करना था। मुख्य आविष्कार नीचे प्रस्तुत हैं।

प्रग्रहण मात्स्यिकी

वर्ष 2006-2007 के दौरान उपांतिक रूप से आकलित समुद्री मछली अवतरण 2.71 मिलियन टन था। इसके मद्दे पिछले वर्ष की तुलना में 4.1 लाख टन मछली की अधिक पकड मिली। कुल अवतरण में 55% वेलापवर्ती, 24% तलमज्जी मछली, 16% परुषकवची और 5 मोलस्क थीं। तारली, फीतामीन, लेस्सर सारडैन, शीर्षपाद, भारतीय बाँगडा, क्रोकर, पर्च, सुरमई और नॉन-पेनिअइड झींगा जैसे वाणिज्य प्रधान मछलियों की पकड में बढती और बंबिल, करंजिड और पेनिअइड झींगा जैसी संपदाओं की पकड में पिछले वर्ष की तुलना में घटती हुई।

केरल और तमिल नाडु के मात्स्यिकी संपदा के आकलन करने का सिमुलेशन मोडल 2005-2015 का विकास किया।

रिपोर्टाधीन वर्ष में गुजरात में मछली अवतरण में करीब 43% बढती हुई। पकड में फीतामीन, नॉन - पेनिअइड झींगा, सूत्रपख ब्रीम की प्रचुरता थी। फीतामीन, बंबिल, ट्यूना, सुरमई, तुंबिल, क्रोकर, बुल्स आइ आदि की पकड अनुकूलतम स्तर से ऊपर और सूत्रपख ब्रीम की पकड अनुकूलतम स्तर पर थी। महाराष्ट्र में फीतामीन, ईल, महाचिंगट, बाँगडा, उपास्थिमीन मछलियों की पकड में बढती हुई; डॉल नेट और गिलनेट परिचालन से भी पकड में वृद्धि हुई जिस से पिछले वर्ष की तुलना में पैदावार में हुई वृद्धि 20% है। महाराष्ट्र की अधिकांश समुद्री संपदाएं अतिविदोहन की भीषणी पर है, इनके परिरक्षण केलिए कदम उठाना अत्यंत आवश्यक है। मत्स्यन यानों में 48% कमी सुझायी गयी है। कर्नाटक का औसत लंबी अवधि पैदावार (ए एल टी वाई) के मद्दे प्राप्त पकड 2.41 लाख टन था। गोवा का ए एल टी वाई 96,065 टन था जबकि प्राप्त कुल पैदावार 1.05 लाख टन था। कर्नटाक और गोवा से यथाक्रम वर्ष दौरान 66,045 लाख और 24,821 लाख रुपयों की मछली प्राप्त हुई। 200 मि ग्रा. भार तक आनेवाले कई वाणिज्य प्रमुख मछलियों केलिए अनुयोज्य जालाक्षि आयाम पर सिफारिश किए गए। केरल के मछली उत्पादन में पिछले वर्ष की तुलना में 10% वृद्धि हुई; यह वेलापवर्ती वर्ग की छोटी मछलियों की पकड के कारण है। वर्ष के दौरान 5.92 लाख टन मछली प्राप्त हुई। लक्षद्वीप के उत्पादन में कमी हुई। यहाँ से येलोफिन ट्यूना, बेलोन और उडन मीन की पकड साध्यता थी। मास के विपणन से मछुवारों ने कुछ आय कमाया। यहाँ के पोल आन्ड लाइन मत्स्यन श्रम अनुकूलतम स्तर पर है; यदि बढ़ाना चाहें तो भी 20% बढया जा सकता है।

तमिलनाडु की मछली पकड में 20% और पोंडिच्चेरी में 15% की बढती हुई। टूटिकॉरिन में सुरमइयों का भारी विदोहन हुआ। पेनिअइड झींगा, नील केकडा और रेतीली महाचिंगट का विदोहन भी उच्चतम वहनीय स्तर पर था। आंध्रा की समुद्री मछली पकड में 36% की वृद्धि हुई। *रास्ट्रेलिगर कानागुर्टा, सारडिनेल्ला गिब्बोसा, ट्रैकूरस लेप्टूरस, थ्रेडफिन ब्रीम्स,* क्रोकर्स और पेनिअइड झींगे का विदोहन अनुकूलतम स्तर पर है जबकि *एस. गट्टाटस* अनुकूलतम स्तर से नीचे हैं। उड़ीसा की पकड में पिछले वर्ष की तुलना में 12% कमी हुई। पश्चिम बंगाल की पकड 2002-2006 के दौरान 1.6 से 2.0 लाख टन के बीच अस्थिर रही।

कृषि मंत्रालय की वित्तीय सहायता से संस्थान ने अखिल भारतीय समुद्री मात्स्यिकी जीव संख्या का आकलन किया। भारत में 3,202 मात्स्यिकी गाँव, इन में 7.6 लाख घराने और कुल 3.52 मिलियन मछुवारे हैं। मछुवारों का लिंग अनुपात, नौकरी संबंधी विवरण, मत्स्यन उपकरण आदि पर विशद रिपोर्ट प्रकाशित की है।

नितलस्थ आनायन से पकडी जानेवाली निम्न मूल्य की कचड़ा मछली और उप पकड की मात्रा 1000 से 40,000 टन आकलित की गई। वेरावल और विशाखपट्टणम में ये सब से अधिक थी। वेरावल में मिली उपपकड का मूल्य करीब 8 करोड और विशाखपट्टणम का 12.6 लाख रुपये थे। उत्तर पश्चिम और मान्नार खाडी पर्यावरण तंत्र के ट्रॉफिक मोडल और मात्स्यिकी प्रबंधन सिमुलेशन्स की तैयारी के लिए 22 मात्स्यिकी और गैर मात्स्यिकी इकोलजिकल ग्रूपों को पहचाना। मछलियों की बढ़त और मृत्युता प्राचल, जैव मात्रा, खाद्य और अशन संबंधी आकलन जारी रखा।

पर्यावरण और जैवविविधता अध्ययन

समुद्री सतह तापमान पर किए क्षेत्रगत और साटलैट अध्ययन में तापमान में समानता दिखायी पडी, इसी प्रकार उत्स्रवण पर किए फील्ड और सैटलैट अध्ययन में भी सहसंबंध दिखाया पडा। वेलापवर्ती जातियाँ जैसे करंजिड, बाँगडा, सुरमई और टूना का बोट्टम *सिगमा* t के साथ सकारात्मक सहसंबंध और विलीन ऑक्सिजन के साथ नकारात्मक सहसंबंध दिखाया पडा।

पिछले 40 वर्षों में समुद्री सतह तापमान में हुए अंतरण से अरब सागर व बंगाल की खाडी की तारली मछलियों का उत्तरी अक्षांश की ओर फैलाव दिखाया पडा। सूत्रपख ब्रीम *नेमिप्टीरस मिसोप्रिओन* का अंडजनन मौसम में शीतकाल की ओर मुडाव भी दिखाया पडा। जलवायु परिवर्तन से तटीय मछुवारों के आवास, खाद्य सुरक्षा आदि पर प्रतिकूल प्रभाव दिखाया पडा।

मछली, कवच मछली और अवसाद में विषैले धातुओं का अंश निर्धारित सीमा में दिखाया पडा। कवच मछलियों में ज्यादा धातु मात्रा, याने कि कड्मियम और लेड मौजूद थे। जियोग्राफिकल सूचना पद्धति से किए अन्वेषणों में समुद्रकृषि और बेडा पालन पद्धति केलिए अनुयोज्य 45 स्थान भारत के समुद्र तटों में पहचाने गए।

उत्तर उडीसा के समुद्र तट में 3000 समुद्री कच्छप *ओलिव रिडले* जालों में फँसे हुए थे, पिछले वर्ष में यह 4000 थे। प्रयोगशाला में उत्पादित 1200 *होलोथूरिया स्काब्रा* के शिशुओं का समुद्र रैंचन किया।

मछलियों की अनुचित पकड पर विचार करते हुए तरुण मछलियों की पकड से होनेवाले नाश पर जागरूकता अभियान आयोजित किया। डॉलनेट, 'तल्लुवलै' आदि संभारों में फँस जानेवाले बंबिल, क्लूपिड, नॉन-पेनिअइड और पेनिअइड झींगे के बचाव पर चिंता प्रकट की। तलमज्जी मछलियों की बढती में कृत्रिम आवास और *बोय* अनुकूल देखा गया। समुद्र में वंशवृद्धि के लिए *पेनिअस सेमिसुलकाटस* और *पिंक्टाडा फ्यूकाटा* का समुद्र रैंचन किया गया। महाचिंगटों के परिरक्षण पर पणधारियों के बीच अवबोध जगाने में संस्थान द्वारा उठाए श्रम सफल हुए।

पूर्व तट, दक्षिण पूर्व तट और आन्डमान समुद्र के 500-1000 मीटर की गहराई में किए गए गभीर सागर मत्स्यन सर्वेक्षण के दौरान पख मछलियों की 111, चिंगटों की 9, केकडों की 3, स्क्विड की 4 जातियों और ग्लास स्पंज की एक जाति को पहचाना गया है। इन दोनों तटों पर गभीर सागर चिंगटों का व्यापक वितरण देखा गया और तेज़ बढ़ने वाले बडे चिंगट *अकान्तेफाइरा अरमाटा* की विदोहन शक्यता भी व्यक्त हो गयी। मांगलूर के पंक धरातलों में ग्लास स्पंज *मोनोराफिस चुनी* की उपस्थिति एक रोचक अवलोकन था।

वर्ष 2006-07 के दौरान संस्थान द्वारा अरब सागर, बंगाल की खाडी और आन्डमान समुद्रों में किए गए पर्यवेक्षण से 106 समुद्री स्तनियों को देखा गया। तिमिगण की 7 जातियों के अशन संबंधी विश्लेषण करने पर आहार नलियों में पख मछलियों का अवशेष दिखाया पडा। तिमिगण के जिगर में वृक्क और पेशी की अपेक्षा मेरक्युरी का संचय अधिक मात्रा में देखा गया। खतरे में पड गयी जाति *ड्यूगोंग ड्यूगोंग* में कीटनाशी पदार्थों का संचय व्यक्त हो गया। चालू वर्ष में 8 समुद्री स्तनी जातियों के 19 में से कुल 24 mt DNA अनुक्रम नमूनों, जेनबैंक (www.ncbi.nt.nih.gov./) में जमा किया गया और अब तक तिमि, डोल्फिन, पोरपोइसस और ड्यूगोंग के डी एन ए अनुक्रम की पुनःस्थापना में संस्थान का योगदान 11 जातियों के 44 नमूनों के 63 डी एन ए अनुक्रम हैं। तट पर धँस गए तिमियों और पकड में अचानक फँस गए डोल्फिनों, पोरपोइसों और ड्यूगोंग की जाति पहचान और लिंग निर्णय के लिए अण्विक वर्गीकरण और पी सी आर आधारित लिंग पहचान तरीका सफल रूप से उपयुक्त किया गया। भारतीय समुद्रों और पसफिक और अटलान्टिक महासमुद्रों के स्पिन्नर डोल्फिनों (*स्टेनेल्ला लॉंगिरोस्ट्रिस*) की जीवसंख्या आनुवंशिक तुलना करने पर हमारे समुद्रों के डोल्फिन स्टॉक में उच्च मात्रा में अंतराल देखा गया। *सोसा-स्टेनेल्ला-टर्सियोप्स-डेल्फिनस* जातियों के मिश्रण और स्पेर्म तिमि (ओडोन्टोसीटी) और बलीन तिमि (मिस्टिसीटी) के बीच के आनुवंशिक संबंध पर कुछ रोचक अवलोकन भी देखने को मिला।

प्रवाल जातियों में *मोन्टिपोरा डिजिटाटा* मान्नार खाडी जैव मंडल आरक्षित क्षेत्र (जी ओ एम बी आर) में सबसे प्रमुख था। मनॉली के चारों ओर की प्रवाल झाड़ी 2.97 की षानन सूचिका के साथ समृद्ध जैव विविधता वाली थी। इस क्षेत्र से गोरगोनिडों और मृदु प्रवालों की दस जातियाँ पहचानी गयी। लगभग 15 वंशों के अंदर आनेवाली पैंतालीस करंजिड जातियों को पहचाना गया और इनकी आकृतीय और गणनीय लक्षण प्रलेखित किए गए।

समुद्री संवर्धन

पानुलिरस होमारस के फिल्लोसोमा डिंभक को PUFA - पोषित *आर्टिमिया* का एकमात्र आहार दिए जाने पर 42 दिनों में डिंभकीय स्तर की VIII वीं अवस्था तक का पालन सफल हो पाया। *पेनिअस सेमीसल्काटस* के लगभग 7.1 मिलियन पश्च डिंभकों का समुद्र रैंचन किया गया। शूली महाचिंगटों को बेहत्तर रंग मिलने केलिए काले रंग के पालन टैंक, प्रतिबंधित प्रकाश, बाहरी बयोफिल्टर युक्त पालन व्यवस्था तथा 70-100 से मी. ऊँचायी का जल उचित देखा गया। श्रृंगिका (आन्टेन्ने) काटने पर आक्रमण स्वभाव और परभक्षिता कम हो गए। *पेनिअस सेमिसल्काटस* के नाला संवर्धन में औसत उत्पादन 0.35 कि ग्रा/मी2 था।

केरल में किए शंबु खेती से वर्ष के दौरान 10,060 टन शंबु प्राप्त हुए। रैक पालन पद्धति में पैदावार 565 ट/हे. और तटीय पालन में 172 ट/ हे. थे। कोषिकोड और मलप्पुरम में संस्थान द्वारा दिये प्रशिक्षण में मछुवारों को शंबु पालन केलिए प्रोत्साहित किया। मुक्ता शुक्ति जातियाँ जैसे *प्टीरिया* और *पिन्ना* में पात्रेन संवर्धन से मोती उत्पादित किया। मुक्ता शुक्ति जातियाँ *पी. माक्सिमा* और *पी.*

मारगरिटिफेरा में समुद्रेन मोती पालन करने की प्रक्रिया जारी रखी। 25 मि मी चूनायित सीपी कवचों में ऑयस्टर स्पाट की अच्छी बस्ती दिखाई पडी। *पाफिया मलबारिका* सीपी बीजों को 10 महीनों में बढती 9.3 मि मी से 32.1 मि मी और अतिजीवितता दर 13% थी। अष्टमुडी झील में बोए *पाफिया मलबारिका* और *पिंक्टाडा फ्यूकाटा* की अच्छी बढ़त हुई।

संस्थान द्वारा विकसित की गयी मेबे पेर्ल प्रौद्योगिकी, कार्यान्वयन केलिए एक कर्मी दल को सौंप दिया। मेबे पेर्ल के नए डिज़ैन तैयार करके इसे एक दस्तकारी उद्योग के रूप में बढाने का कदम उठाया। आंडमान में प्राकृतिक आवास स्थानों की कमी से मोतियों में इतर रूपिम दिखाया पडा। गोवा में शंबु पालन पर किसानों को प्रशिक्षण दिया गया।

पाक खाडी में समुद्री शैवाल *काप्पाफैकस अल्वरेज़ि* का सात गुणा, कालिकट में ग्यारह गुणा, और नवीबंदर में पन्द्रह गुणा उत्पादन वृद्धि हुई। तटीय सिमेंट टैंक में केकडों के साथ पालन करने पर भार में दुगुणा वृद्धि हुई। जाल की थैलियों में, नारक्कल, कोची में 90 दिवस पालन करने पर 215 कि ग्रा. *के. अल्वरेज़ि* का पैदावार मिला।

पहली बार राबिट फिश, *सिगान्स कनालिकुलाटस* का अंडजनन व डिंभक पालन पर विजय प्राप्त हुआ। डामसेल मछली की तीन जातियों का संतति उत्पादन मानकीकृत किया गया। ब्लू ग्रीन डामसेल मछली का अंडशावक विकास और डिंभक पालन पहली बार सफल हुआ। स्पैन-चीक अनिमॉन फिश *प्रेमनास बयाकुलेटस* का बंद अवस्था में अंडजनन देखने लायक उपलब्धि थी। वर्ष के दौरान 9500 क्लाऊन मछली संततियों का विपणन किया। समुद्री मछलियों के डिंभक पालन केलिए उपयुक्त कोपिपोड सह-संवर्धन में सफलता पाई।

सूक्ष्मशैवाल के कुछ नए नसलों का विघटन और अनुरक्षण किया। हरितजल पद्धति में *नानोक्लोरोप्सिस* अधिक होने पर नीली डामसेल मछलियों की अशन तीव्रता उच्च हो गयी।

सीबास *लेटस कालकारिफर* की संततियों के संभरण किए। तैरनेवाला पंजर विशाखपट्टणम और गोवा में स्थापित किया।

जैवप्रौद्योगिकी

ट्यूना मछली और तरकारी अपशिष्टों के सह-किण्वन में अमिनोआसिड अंश में 24% की वृद्धि हुई। किण्वित किए ट्यूना अपशिष्ट क्लाउन मछलियों की बढ़त केलिए अनुयोज्य देखा। *बासिलस कोयागुलन्स* के कच्चे निकर्ष से फैटेस और आसिड फोसफेटेस एनज़ाइम निकाले गए। *प्स्यूडोमोनास प्लूरोसेन्स* से ट्रयासिलग्लिसरोल लिपेस का विघटन किया। महाचिंगट और नीली केकडा की अतिजीवितता और बढती में *स्क्विल्ला* मांस ने परस्पर विरुद्ध प्रभाव दिखाया।

पालन की गई जाति से विब्रियो के 18 अइसोलेटों के जैवरासायनिक अभिलक्षण संबंधी अध्ययन किया गया। *वी. वल्निफिकस* के 2 स्ट्रेन ग्रूपरों पर मृत्युता जगाते हुए देखा। समुद्रकृषि खेतों में *विब्रियो आंगुलारियम* को पहचानने का पी सी आर रोगनिदानक विकसित किया। *हिप्नीआ म्यूसिफोर्मिस* से निकाला डाइक्लोरोमीथेन ने उच्च प्रतिजीवाण्विक सक्रियता दिखाई। झींगा फार्मों में पाले मोनोडोन झींगों में होनेवाले WSSV को पहचानने केलिए किए हिस्टोपातोलजी परीक्षण में 72 परीक्षणों ने PCR से सकरात्मक संबंध व बाकी अधिकांश ने नकारात्मक संबंध दिखाया।

बंबिल की आनुवंशिकता पर किए अध्ययन ने उत्तरपूर्व और उत्तरपश्चिम तटों से मिली संपदाओं में अन्तर दिखाया। महाचिंगटों की कुछ जातियों में जाति - निदानक RAPD बैंडों का विकास किया।

विस्तार और आर्थिकी

वर्ष के दौरान मात्स्यिकी संपदाएं जैसे सुरा, रोककोड, स्नाप्पर, पांफ्रेट और केकडा ने थोक और खुदरा व्यापार में अच्छा दाम पाया। पिछले वर्ष की तुलना में मछली के मूल्य में चढाव दिखाया पड़ा। आय का 50% चिंगट और शीर्षपाद संपदाओं से प्राप्त हुआ था।

आंध्रप्रदेश में अधिक निवेश से उच्चतम उत्पादकता प्राप्त हुई तो केरल में अधिक-श्रम से उच्चतम उत्पादकता। आंध्रप्रदेश और केरल के उत्पादकता विश्लेषण संबंधी अध्ययन ने व्यक्त किया कि दोनों राज्यों में श्रम और पूँजी उत्पादकता में सकारात्मक संबंध है। मानसून मत्स्यन रोक पर आंध्रप्रदेश, तमिल नाडु, उड़ीसा, पश्चिम बंगाल, कर्नाटक, गुजरात और महाराष्ट्र के मछुवारों ने सहमति प्रकट की तो केरल के 50% यंत्रीकृत सेक्टर के मछुवारों ने इस पर अपना विरोध प्रकट किया। 30% मछुवा समुदाय इस समय गैर - मात्स्यिकी कार्यकलापों में लगे रहते हैं। शंबु पालन पर कालीकट में किए अध्ययन ने इसके पालन में प्रतिकूल स्थिति सूचित की।

प्रकाशन, नई परियोजनाएं और मान्यताएं

संस्थान के कार्मिकों ने 40 ताक - झाँक किए शोध पत्रों, 17 लोकप्रिय लेखों, 67 तकनीकी लेखों और संगोष्ठी/परिचर्चा में 11 शोध पत्रों का प्रस्तुतीकरण किया। वर्ष 2006-07 के दौरान संस्थान ने 1 बुल्लेटिन और 5 विशेष प्रकाशनों का विमोचन किया। भारत में

मात्स्यिकी अनुसंधान के प्रभाव पर भारतीय कृषि अनुसंधान परिषद की एक नई परियोजना-नेटवर्क का अनुमोदन मिला। भारतीय कृषि अनुसंधान परिषद के अधीन वर्ष 2004-2005 में प्रकाशित श्रेष्ठ वार्षिक रिपोर्ट के रूप में संस्थान का वार्षिक रिपोर्ट 2004-05 को पुरस्कार प्राप्त हुआ। भारतीय कृषि अनुसंधान परिषद के अधीन स्थापित वर्ष 2004-2005 की उत्तम हिंदी पत्रिका का गणेश शंकर विद्यार्थी पुरस्कार संस्थान का विशेष प्रकाशन मत्स्यगंधा ने हासिल किया।

परामर्श सेवाएं

संस्थान ने वर्ष के दौरान विविध अभिकरणों को दी गई परामर्श सेवाओं से 16.89 लाख रुपए जगाए।

प्रशिक्षण और शिक्षा

वर्ष 2006 के दौरान 4 नियमित छात्रों और वरिष्ठ परियोजना अनुसंधेताओं ने डॉक्टरल उपाधि हासिल की। केंद्रीय मात्स्यिकी प्रशिक्षण संस्थान मुम्बई ने 4 छात्रों को स्नातकोत्तर शिक्षा में उपाधि प्रदान की। नारक्कल के कृषि विज्ञान केंद्र ने 75 प्रशिक्षण पाठ्यक्रमों के अतिरिक्त निदर्शन कार्यक्रम और खेत परीक्षण कार्यक्रम आयोजित किए।

राजस्व का अर्जन

वर्ष के दौरान संस्थान ने 115.18 लाख रुपयों का राजस्व जगाया।

ISSN 0972-2378

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CMFRI

वार्षिक प्रतिवेदन
Annual Report
2006-07

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Acronyms Used

ADAK	Association for Development of Aquaculture in Kerala
ATIC	Agricultural Technology Information Centre
BFFDA	Brackishwater Fish Farmers Development Agency
CARI	Central Agricultural Research Institute
CGP	Competitive Grants Programme
CIBA	Central Institute of Brackishwater Aquaculture
CIFA	Central Institute of Freshwater Aquaculture
CIFE	Central Institute of Fisheries Education
CIFT	Central Institute of Fisheries Technology
CMFRI	Central Marine Fisheries Research Institute
CoF	College of Fisheries, Mangalore
DBT	Department of Bio-Technology
DOD	Department of Ocean Development
DST	Department of Science & Technology
E	Exploitation Rate
FAO	Food and Agricultural Organisation
FSI	Fishery Survey of India
GAU	Gujarat Agricultural University
GOPL	GMR PSEG Operations Private Limited, Mangalore
IASRI	Indian Agricultural Statistics Research Institute
ICAR	Indian Council of Agricultural Research
IFS	International Foundation of Science
IGIDR	Indira Gandhi Institute of Development Research
IOTC	Indian Ocean Tuna Commission
ISD	Information System Development
IVLP	Institution Village Linkage Programme
KIOCL	Kudremukh Iron Ore Company Limited
KKV	Konkan Krishi Vidhyapeeth
MM	Mission Mode
MOE&F / MEF	Ministry of Environment & Forest
MPEDA	Marine Products Export Development Authority
MRPL	Mangalore Refineries and Petrochemicals Limited
MSY	Maximum Sustainable Yield
NAARM	National Academy of Agricultural Research Management
NABARD	National Bank for Agricultural and Rural Development
NATP	National Agricultural Technology Project
NBFGR	National Bureau of Fish Genetic Resources
NGOs	Non-Governmental Organisations
NIO	National Institute of Oceanography
PSR	Production Systems Research
RC	Research Centre
RGCA	Rajiv Gandhi Centre for Aquaculture
SEAFDEC	South East Asian Fisheries Development Centre
SFDs	State Fisheries Departments
TANUVAS	Tamil Nadu Veterinary and Animal Science University
WFC	World Fish Centre
Z	Mortality Rate